SECTION

I

AMA Overview

Preface

Section I of the Third Management Plan provides an overview of the Arizona Department of Water Resources' (Department) water management approach; a description of the physical conditions, hydrology, and water resources of the Santa Cruz Active Management Area (AMA); and a detailed description of the characteristics of various water use sectors within the AMA. The physical water resources data presented in Chapter 2 and the historic water use and associated water use trends described in Chapter 3 provided the Department with important information from which it analyzed water supplies and demands. Information presented in this section was also used in developing water management programs which are presented in Section II and the future conditions and directions presented in Section III.

In Section I, the Department intends to provide the reader with a better understanding of the management approach, the water resources, and the water use characteristics of the Santa Cruz AMA. Such an overview is necessary to better appreciate the reasoning, perspective, and methods being used by the Department to develop a long-term water management strategy for the Santa Cruz AMA, with particular emphasis on the third management period (2000 to 2010).

CHAPTER

1

Water Management Approach

1.1 CHAPTER ORIENTATION

This chapter describes the goals, objectives, and contents of the Third Management Plan within the context of the Arizona Department of Water Resources (Department) and the Groundwater Code (Code). It also provides an overview of the Santa Cruz Active Management Area (AMA) and the conditions that make it unique among the five AMAs. The following topics are discussed:

- Arizona Department of Water Resources' mission
- Overview of the Code and some of its key provisions
- A discussion of the safe-yield concept and Santa Cruz AMA management goals
- An institutional overview of the Santa Cruz AMA
- The principles, objectives, and content of the Third Management Plan
- Emerging challenges for the Santa Cruz AMA

1.2 THE ARIZONA DEPARTMENT OF WATER RESOURCES

The Department was created by the 1980 Groundwater Code to manage the water resources of Arizona. The Department administers state laws, explores methods of augmenting water supplies to meet future demands, and works to develop public policies that promote efficient use and equitable allocation of available water supplies. To secure long-term water supplies for Arizona, the Department oversees the use of surface water and groundwater in the state and represents the state's interests in interstate and federal issues. The mission of the Department is:

> *To ensure a long-term, sufficient and secure water supply for the state; to develop public policy which promotes efficient use and equitable distribution of water in an environmentally and economically sound manner; and, to promote the management of floodplains and dams to reduce loss of life and damage to property.*

1.3 THE ARIZONA GROUNDWATER CODE

In 1980, Arizona made a commitment to the long-term management and conservation of its limited groundwater supplies through the passage of the Code, which is the cornerstone of Arizona's water management efforts. In general, the goals of the Code are to eliminate severe groundwater overdraft in areas of the state where groundwater supplies have been rapidly diminishing and to provide the means for allocating Arizona's limited groundwater resources to most effectively meet the state's changing water needs. Goals to maintain safe-yield and prevent local water tables from experiencing long-term declines were established for the Santa Cruz AMA due to local hydrology and water resource management issues. To achieve this dual goal, the Code authorizes the Department to manage all water withdrawn from wells, other than stored water, in the Santa Cruz AMA.

The Code limits withdrawals of groundwater within AMAs to holders of grandfathered rights, service area rights, groundwater withdrawal permits, and to small domestic water users. Under the Code, water uses existing in 1980 were allowed to continue within the limits established under a new water rights system, and new uses were required to be consistent with the management plans and goals of the AMAs. Readers who are not familiar with the different types of groundwater rights established by the Code are encouraged to read the Glossary of Terms attached as a supplement to the management plan. The Code also contains provisions to limit water use through conservation and the use of renewable water sources. The full text of the Code can be found on the following Web site: www.azleg.state.az.us under Title 45, Water.

1.3.1 The Groundwater Problem

The Code was enacted in response to serious water level declines in the aquifers in central and southern parts of the state. Groundwater overdraft in Arizona has resulted in the lowering of groundwater levels by as much as 600 feet in some locations. In some areas, groundwater depletion has made it economically infeasible to pump water, has caused the lowering and cracking of the land surface (subsidence), and has resulted in water quality problems due to the migration of contaminated water and general deterioration of aquifer water quality with depth. Long-term overdraft of groundwater supplies will exacerbate these problems.

1.3.2 Provisions of the Groundwater Code

The regulatory provisions of the Code are focused primarily on areas of the state that have been designated as AMAs. These areas are located where competition for water supplies is most severe, primarily in the central and southern parts of the state. Statewide, there are provisions addressing well drilling, well registration, and construction requirements; water supply adequacy requirements for new subdivisions; and limitations on transportation of groundwater across watershed boundaries. The Santa Cruz AMA has additional requirements contained in this plan for well spacing.

Within AMAs, the Code established a new groundwater rights system which strictly limits groundwater withdrawals; prohibits the development of new irrigated farmland; requires new subdivisions to have long-term, dependable supplies; and requires measuring and reporting of groundwater withdrawals. As explained at appropriate points in this management plan, many of these provisions apply to right holders who withdraw water from a well in the Santa Cruz AMA.

Management goals are established for each AMA, and a series of five management plans containing mandatory conservation requirements for industrial, municipal, and agricultural water users must be developed. Other programs within AMAs include conservation assistance, augmentation, and monitoring of the water supplies.

The Code also established Irrigation Non-Expansion Areas (INAs). Within these areas there can be no new irrigated land and owners of large wells are required to meter their water use and file annual reports with the Department. Otherwise, groundwater management in INAs is not highly structured.

1.3.2.1 Creation of the Active Management Areas and Irrigation Non-Expansion Areas

Upon enactment of the Code, four AMAs were established in Phoenix, Tucson, Pinal, and Prescott. In 1994, the Arizona legislature enacted Senate Bill 1380 and thereby established the Santa Cruz AMA. In that legislation, the legislature recognized that the international nature of water management issues facing the Upper Santa Cruz River Basin differed significantly from the other basins of the Tucson AMA, which, until the enactment of Senate Bill 1380, included this basin. The legislature specifically noted that the hydrology of the basin required coordinated management of surface water and groundwater. The legislature also recognized the desire of the water-using community of the Upper Santa Cruz River Basin to create the Santa Cruz AMA in order to participate in local water resource management and binational coordination efforts. A.R.S. § 45-411.04.

In recognizing that the hydrology of the Upper Santa Cruz River Basin requires a "coordinated management of surface water rights and groundwater rights" to meet the water management goals of the area, the legislature set a new course for water management in the Santa Cruz AMA. Unique among the AMAs in Arizona, the Santa Cruz AMA management programs are designed to address all water withdrawn from a well, whether that water is groundwater or surface water, pursuant to A.R.S. § 45-566. The legislature also specified that the creation of the Santa Cruz AMA, and this coordinated management of surface and groundwater rights was not to "affect the definition of, or rights to, the surface waters and groundwater within this state." A.R.S. § 45-411.04(C).

Boundaries of the AMAs are based primarily on groundwater basin divides, but they take into account water use patterns as well. The Code also established two INAs: Douglas and Joseph City. A third INA, Harquahala, was designated by the director in 1982. Figure 1-1 shows the location of the five AMAs and the three INAs. Figure 1-2 shows the boundaries and major features of the Santa Cruz AMA. The Douglas INA is managed from the Tucson AMA office. The Joseph City and Harquahala INAs are managed from the Phoenix AMA office.

1.3.2.2 The Management Goals

For three of the AMAs, Prescott, Tucson, and Phoenix, the management goal to be reached by the year 2025 or earlier is safe-yield. The attainment of this goal is expected to occur incrementally over the five management periods. Maintaining the safe-yield goal beyond 2025 may become more and more difficult over time as demand increases due to municipal and industrial growth and renewable supply surpluses decrease.

In the Pinal AMA, where a predominately agricultural economy exists, the goal is to protect the agricultural economy as long as feasible and preserve water supplies for future non-agricultural purposes. In order to address the unique hydrologic nature of the Santa Cruz AMA, the goal requires the AMA to maintain a safe-yield condition and prevent local water tables from experiencing long-term declines.

Safe-yield, as defined in the Code, means "to achieve and thereafter maintain a long-term balance between the annual amount of groundwater withdrawn in an active management area and the annual amount of natural and artificial groundwater recharge in the active management area." A.R.S. § 45-561(12). The volume of groundwater that can be withdrawn while maintaining a safe-yield condition in the AMA will not be a fixed amount; it will change due to annual variations in incidental recharge, natural recharge, and safe-yield recharge. The Department uses tools such as hydrologic models, water budgets and an analysis of water table level changes across the entire AMA to help determine an AMA's status relative to its safe-yield goal.

The goal of preventing long-term declines in local water table levels is defined in the Santa Cruz AMA as maintaining a target water level, consistent with state surface water and groundwater laws which could vary by hydrologic segments, that on average must be maintained subject to natural fluctuations. If long-term water level trends (after adjusting for stored credits) show declines for a particular hydrologic segment, natural or artificial recharge, and potentially a reduction in water withdrawals will have to occur to allow the local water table level to recover and reattain its target level. If long-term local water table levels rise (after adjusting for stored credits) above the target due to variations in incidental recharge and natural recharge, water withdrawals may be increased. Evaluations of the impacts of withdrawals on long-term local water table levels made at regular intervals will help ensure long-term water table level stability.

Information from annual water use reports is used to estimate the volume of water withdrawals, water stored, and recovered water in an AMA. Water budgets are constructed to illustrate the total supply and demand picture. Because the Santa Cruz AMA goal is to maintain safe-yield conditions, water levels need to be monitored in the context of a hydrologic model to ensure that the AMA goal is maintained and to understand the effects of stored water. Hydrologic models can be used to predict changes in water levels based on projected water withdrawals and credit recovery patterns and to verify assumptions in the water budget.

Safe-yield is achieved on an AMA-wide basis; the Code does not recognize localized achievement of safe-yield. The amount of water withdrawn under safe-yield conditions is not allocated on a subbasin or local basis. It is anticipated that under safe-yield conditions on an AMA-wide basis some areas may be depleted, some areas of active recharge may be in surplus, and other hydrologic segments will be required by the Santa Cruz AMA goal to achieve a localized balance between the amount of water recharged and withdrawn.

Since the development of the Second Management Plan, new information has become available regarding the physical availability and distribution of water supplies. For example, recent publications by the United States Geological Survey (USGS) have heightened awareness of the potential for land subsidence in some AMAs. This improved understanding of the risks associated with ongoing pumpage in certain areas brings a new perspective to safe-yield. It is clear that a more site-specific, local resource management approach is needed in parts of other AMAs in addition to the Santa Cruz AMA. Additional tools may be required to develop a more resource-based, localized water management program in the other AMAs.

During the third management period, a critical area management strategy will be evaluated for the other AMAs which establishes additional water management goals for specific geographic areas within the AMA. These goals may relate to mitigation of subsidence, water supply reliability, water quality management, implementation of Indian water rights settlements, or other groundwater supply-related considerations. The goal of the Santa Cruz AMA already provides for local management of water table levels. It is possible that other areas of the AMA may be identified for critical management during the third management period.

1.3.2.2.1 Local Water Tables

The Santa Cruz AMA was given a dual goal by the legislature. The first component of the management goal is to maintain safe-yield on an AMA-wide basis. The second component is to prevent local water tables from experiencing long-term declines. This component of the goal requires careful consideration of very localized conditions (described in chapters 2, 3, and 8) in examining water management issues, in comparison to the AMA-wide nature of the safe-yield component.

The Department believes that practical considerations help define this goal. An extreme view of this goal would require strict regulation of water levels everywhere in the AMA. However, the Department believes such universal controls are not needed at this time and that water interests within the Santa Cruz AMA would not welcome micro-management of water resources throughout the entire AMA. On the other hand, viewing this goal as requiring only an AMA-wide balance would render it indistinguishable from the safe-yield component of the management goal.

After evaluating a number of possible local water management approaches, the Santa Cruz AMA community has elected to set target water levels that can vary by hydrologic segments, which must be maintained on average, subject to natural fluctuations. The target water levels must be consistent with state surface water and groundwater laws. Based on input from local water interests and because the most critical water management issues in the AMA center upon the Younger Alluvium of the Santa Cruz River, the Department recommended that its water management efforts should concentrate on the Younger Alluvium of the Santa Cruz River and those tributaries and formations, including certain Older Alluvium formations, that contribute water to the Younger Alluvium. Initial management efforts are best focused on these Younger Alluvium areas which are: (1) subject to competing multiple use objectives, (2) most sensitive to changes in water levels, and (3) relied upon for most of the region's water supply.

During the third management period, the Department will work to adapt its regulatory programs for the Santa Cruz AMA within the framework established in the AMA's management goal.

1.3.2.3 Management Plans

To achieve the management goal(s) for each AMA, water conservation and management requirements are established in each of five management periods. The five management periods are as follows:

First Management Period:	1980-1990
Second Management Period:	1990-2000
Third Management Period:	2000-2010
Fourth Management Period:	2010-2020
Fifth Management Period:	2020-2025

Requirements for each management period are described in separate management plans prepared for each AMA. The management plans for the Santa Cruz AMA must include water conservation requirements for "...all non-irrigation uses of water, other than stored water, withdrawn from a well," (A.R.S. § 45-566.A(2)); a water quality assessment and management program; an augmentation and recharge program; conservation assistance programs; and other management programs that define how the AMA will achieve its management goals.

The management plans for all the AMAs must also quantify the volume of the groundwater right for agricultural and municipal users. For example, in the case of Irrigation Grandfathered Rights, the right established in the Code is to irrigate particular acres of land that were historically irrigated. The volume of water that may be applied to that acreage, the "water duty," is defined in the management plans. Similarly, service area rights for municipal users are not quantified in the Code but are quantified through the gallons per capita per day program in the management plan. Because agricultural and municipal water users in the Santa Cruz AMA withdraw water from wells, these provisions of the Code and management plans are applicable.

In each successive management period, the preparation of a management plan provides the Department and AMA water users with the opportunity to analyze the effectiveness of previous water management efforts and address water management issues in the AMA. Adjustments in water management strategies and conservation requirements are made in each successive plan to help achieve management goals.

The First Management Plan was the first step toward a comprehensive and effective management program. The plan initiated conservation programs and focused attention on important water management issues. The Second Management Plan expanded on the conservation programs of the First Management Plan and integrated water augmentation into the AMA management strategy. The Second Management Plan placed a strong focus on evaluation of conservation potential and implementation of water conservation measures to achieve cost-effective levels of efficiency in water use. New programs for conservation and augmentation assistance were included as well.

Even after the implementation of two management plans, water management problems persist in all five AMAs. Because the water users and right holders of the Santa Cruz AMA were regulated under the Tucson AMA First and Second Management Plans, the Third Management Plan will be the first prepared specifically for the Santa Cruz AMA.

The Third Management Plan establishes water management strategies that include water conservation, augmentation, recharge, and water quality management by the agricultural, municipal, and industrial sectors to help achieve the AMA goals. The Department recognizes that the Third Management Plan is the initial step in water management for the Santa Cruz AMA. The development of additional rules and new legislation will be needed to address the unique character of the Santa Cruz AMA and achieve the AMA's dual goal.

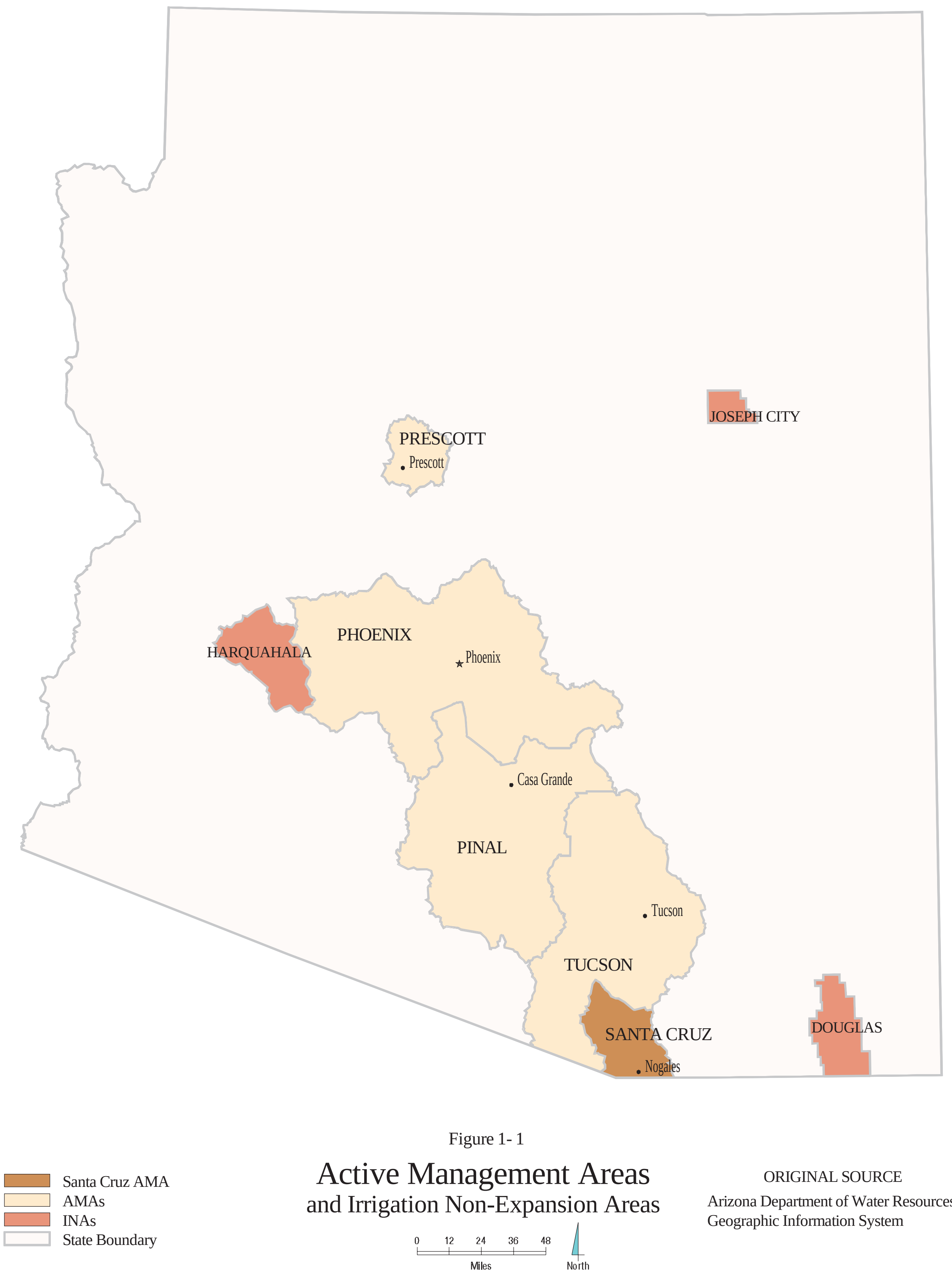


Figure 1- 1

Active Management Areas
and Irrigation Non-Expansion Areas

ORIGINAL SOURCE
Arizona Department of Water Resources
Geographic Information System

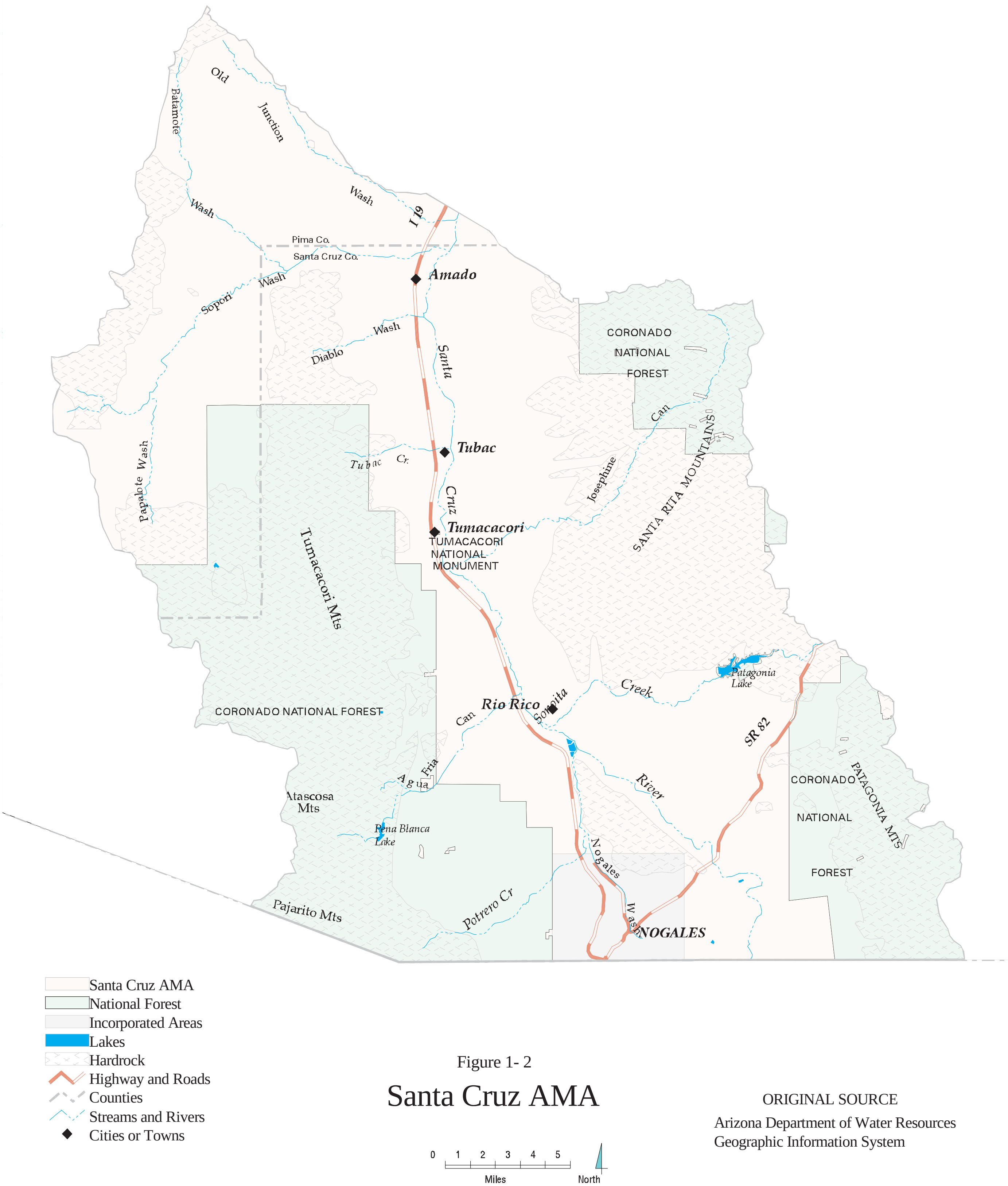


Figure 1- 2

Santa Cruz AMA

ORIGINAL SOURCE
Arizona Department of Water Resources
Geographic Information System

Because the Third Management Plan is the first prepared specifically for the Santa Cruz AMA, water conservation requirements contained in this plan are similar in structure to those established in the Second Management Plan. Changes in the Third Management Plan address comments received from regulated water users, additional water management issues, and local water management concerns. The Third Management Plan describes the developing role the Department and the water users must play in meeting local, regional, and statewide water management objectives. Achievement of the AMA goals and other water management objectives will require community-wide support and commitment and the development and adoption of rules and legislative changes.

1.3.2.4 Assured Water Supply Program

The Code prohibits the sale or lease of subdivided land in an AMA without the demonstration of an assured water supply. The Assured Water Supply Program (AWS Program) was instituted in 1980, but substantially strengthened in 1995 with adoption of the Assured Water Supply Rules (AWS Rules). Under the AWS Rules, new development within an AMA must demonstrate that sufficient water supplies of adequate quantity and quality are available to meet proposed uses for 100 years. The AWS Rules require the utilization of these supplies to be consistent with the AMA goal(s). Only after demonstration of sufficient water supply can a development be approved for sale to the public. Because the AWS Rules were being adopted at the same time that the Santa Cruz AMA was being created, consistency with AMA goal criteria for the Santa Cruz AMA are not included. After numerous discussions with the Santa Cruz AMA community, the Department drafted the Santa Cruz Active Management Area Management Goal and Program Implementation Concept Paper in July, 1997. This paper explores interpretations of the management goals, water management issues, and water management program implementation concepts for the Santa Cruz AMA. Currently, the Department is drafting AWS consistency with management goal rules for the Santa Cruz AMA, based on the concept paper and additional discussions with the community that have occurred since the concept paper was written.

The AWS Rules apply to developers who seek a Certificate of Assured Water Supply (Certificate of AWS) for an individual subdivision and to water providers seeking a Designation of Assured Water Supply (Designation of AWS). A Designation of AWS results from a demonstration that there are adequate water supplies available to the provider to meet current and future demands of the customers currently on their system, and the demands of customers they have committed to serve, for 100 years. The water supplies used to demonstrate an assured water supply may include surface water and effluent, and in some AMAs may also include imported groundwater, credits from extinguishment of groundwater rights, a quantity of allowable groundwater use specified by the AWS Rules, or water stored pursuant to an underground storage permit. The AWS Program plays a key role in achievement of the management goals since it requires that the water use sector with the greatest potential for growth in the AMA carefully plan and prepare for future current and committed water demands to be met in a manner that will result in the maintenance of safe-yield conditions and prevention of long-term declines in local water table levels.

1.3.2.5 Revisions to the Groundwater Code

Since 1980, the Code has undergone numerous changes to address emerging water management issues. The creation of the Santa Cruz AMA from a portion of the Tucson AMA in 1994 established for the first time the ability of this region to address its own unique water management problems, including hydrologic conditions and international issues. In addition, sections have been added to the Code that limit the use of water in artificial lakes, address underground storage and recovery of water, limit transfers of groundwater between groundwater basins statewide, establish groundwater replenishment districts and other entities designed to facilitate the use of renewable supplies, establish the water conservation assistance program, and provide alternative municipal and agricultural conservation programs. In addition, numerous changes have been made to expand or clarify previous language and deregulate small groundwater users.

Throughout this process, the fundamental concepts of allocating the right to use groundwater and planning for the efficient and economic use of water have been preserved. The Code, as comprehensive as it is, does not contain detailed instructions on how to manage water resources. Instead it provides a framework from which water management decisions are made in the AMAs. The Department and the local water users, through the development and implementation of the management plans and community-based decisions, will establish management strategies to allow for achievement of the AMA goals, while coordinating with Sonoran water management practices and objectives for the internationally shared basin, as authorized by the Arizona state legislature.

1.4 GOVERNMENTAL AND INSTITUTIONAL SETTING

Water management activities within the Santa Cruz AMA are carried out by a number of entities. City, county, and regional government functions include retail water delivery, flood control, wastewater management, water quality management, planning, and zoning. Several user groups, advisory committees, citizen's groups, and other organizations play significant roles in developing legislative and policy guidelines and educational programs relating to water resource use and conservation. The Groundwater Users Advisory Council (GUAC) for each AMA advises the director of the AMA and the director of the Department on issues relating to groundwater management in the AMA.

The Arizona Water Protection Fund (AWPF) was established in 1994 to provide grant monies for implementation of projects to protect or restore the state's riparian areas. The Fund may be used to purchase CAP water or effluent for riparian enhancement. The AWPF Commission oversees the grants process; the director of the Department serves as an ex-officio member on the Commission and the staff are located within the Department.

At the state level, the Arizona Department of Environmental Quality (ADEQ) develops and enforces water quality regulations. Through recent legislation (amending provisions of the Water Quality Assurance Revolving Fund (WQARF)) the Department and ADEQ jointly participate in specified activities related to protection of groundwater quality and remediation.

The Arizona Corporation Commission (ACC) regulates the activities of private water companies, particularly those related to rate-setting. The Arizona Department of Real Estate works with the Department to assure availability of water for new subdivisions.

Federal water management activities in the Santa Cruz area include the Bureau of Reclamation's involvement in regional water supply planning and participation in negotiations to provide water resources to Indian communities on behalf of the Secretary of the Interior. Additional federal water management activities include Army Corps of Engineers' Studies, the Environmental Protection Agency's Superfund program, and the National Pollutant Discharge Elimination System permit program. The USGS works independently and in conjunction with the Department in the collection and analysis of hydrologic and subsidence-related data and flood warning information.

In the Santa Cruz AMA, the International Boundary and Water Commission (IBWC) is made up of two sections, one from Mexico and one from the United States. Each section is headed by an engineer-commissioner appointed by the president of each country, who in turn receives policy guidance from respective foreign offices: the State Department for the United States and the Secretary of Foreign Relations for Mexico. The IBWC conducts studies on boundary and international water matters within its jurisdiction. In the Santa Cruz AMA, the IBWC co-owns the Nogales International Wastewater Treatment Plant, which generates an important volume of effluent. The IBWC also helps in the formal interchange of information related to transboundary water basins (Santa Cruz River and Nogales Wash). In creating the Santa Cruz AMA, the Arizona state legislature recognized the importance of facilitating binational negotiations for coordinated management of the water resources of the Santa Cruz River. A.R.S. § 45-411.04(A).

1.5 DEVELOPMENT OF THE THIRD MANAGEMENT PLAN

Preparation of the Third Management Plan has been guided by a set of overriding principles and specific objectives. These principles and objectives and the Third Management Plan development process are described below.

1.5.1 Guiding Principles in Program Development

The Code provides the Department with a series of management tools, some of which are more effective than others. In addition to the Code, general management principles have been developed to guide the operations of the Department and preparation of the Third Management Plan. These are:

- **The authorities granted to the Department must be integrated into a coordinated strategy for meeting the management goals of the AMA.** Numerous tools are provided by the statutory structure to assist in meeting water management objectives. These tools include: (1) binational water management coordination authority, (2) water rights components of the Code, (3) assured water supply provisions, (4) underground storage and recovery provisions, (5) permitting requirements and conditions, (6) authority to develop well-spacing rules, (7) AWBA and AWPF activities, (8) conservation and augmentation assistance programs, and (9) water use reporting and enforcement authorities. All of these activities must be integrated and focused toward meeting the goals.

- **Local water management issues must be addressed as regional and statewide strategies are developed.** There must be recognition of the impacts that regional or statewide water management programs can have on local water users in the Santa Cruz AMA.

- **Effective water management must include both supply augmentation and demand management programs.** Supply augmentation includes storage of excess renewable water for future use and utilization of effluent. The demand management includes ensuring efficient water use in new development and encouraging water conservation among existing users. Demand management extends the availability of existing water supplies to serve more uses over a longer time frame.

- **Effective and efficient water management must take a long-term perspective and be both regional (AMA-wide) and local (water table levels) in scope.** The Department is responsible for ensuring that sustainable water supplies are available for future generations. Managing the water supplies to maintain safe-yield conditions on an AMA basis will help ensure water supply availability into the future. Managing local water table levels will maintain the quality of life and help preserve water availability in portions of the AMA sensitive to fluctuations in water table levels.

- **All water sources need to be included in any long-term, comprehensive water management strategy.** Because of the difficulty in distinguishing between groundwater, surface water, and effluent sources in the Younger Alluvium of the Santa Cruz River, the legislature expressly provided that all water withdrawn from wells be included in water management in the Santa Cruz AMA. Areas of the AMA outside of the Younger Alluvium are largely groundwater dependent and alternative supplies are not generally economically feasible to obtain. Water management in these portions of the AMA may be different from, but not less important than, water management within the Younger Alluvium.

- **Water users must have an integral role in management program development and implementation.** Water users with expertise in their own water use sector must play a major role in the development and implementation of water management programs in order to ensure the success of these programs.

- **Water management efforts must consider economic impacts and feasibility.** Attaining water management goals requires the expenditure of public and private funds, which must be used as effectively and efficiently as possible. Therefore, water management strategies must be developed using sound economic principles.

- **Educating the public on water issues and involving the public in developing management programs are essential to building and sustaining an effective water management effort.** It is ultimately the members of the public who are asked to commit to implementing water management strategies. It is essential to provide them with the information they need to make informed choices and the opportunity to participate in developing water management programs.

- **Water management efforts should be consistent with, and enhance, the quality of life in the community.** Social values and environmental quality considerations are integral to the development of water management approaches in Arizona. Adverse impacts on the quality of life and the potential for economic development must be avoided to the greatest extent possible.

- **The Department's water management efforts must recognize that water users, water service area customers, water providers, municipal governments, and the real estate industry are important decision-makers.** The role of the Department's programs and regulatory tools is to create a decision-making environment that results in good water management decisions and investments.

- **Water supplies available today must be used to meet the needs of the future.** Any excess supplies available during the third management period must be managed to meet growing AMA demands and provide adequate supplies during future water shortages. Underground storage of excess supplies and direct use of effluent are important components of successful water management.

- **Water management programs should provide a stable institutional framework which creates an environment of certainty in water resource decision-making.** Water users and providers must commit to, and implement, long-range plans in a world of evolving regulations. The provision of a predictable framework within which these regulations will evolve reduces uncertainty. Involvement in binational negotiations at the state level, through the Santa Cruz AMA, ensures local understanding and investment in resolution of water management issues. Local water management efforts will help provide certainty and stability. Additionally, management programs must be clearly stated and free of ambiguity, while maintaining flexibility to respond to changing conditions.

- **Water management programs should be based on the premise that future issues are unlikely to be the same as those we have encountered in the past, and that the pace of change is likely to increase.** In order to provide maximum flexibility for the future, databases must be maintained and enhanced, and tools developed to improve our understanding of the AMA hydrologic system, to identify trends early, and to test scenarios that vary from current conditions.

1.5.2 Third Management Plan Objectives

The following objectives must be achieved during the third management period:

- The Department will establish and implement Third Management Plan water conservation requirements for all non-irrigation water, other than stored water, withdrawn from a well, as equitably as possible. Conservation requirements will also be established and implemented for irrigation uses of water. A.R.S. § 45-566(A). Public acceptance and economic, technical, health, and environmental constraints will be considered when establishing these requirements. Flexibility will be provided as appropriate to address water users who, while implementing effective conservation measures, may not be able to comply with specific conservation regulations. Unique circumstances may be addressed through alternative conservation requirements designed to result in equivalent conservation or through variance or administrative review procedures provided for by statute.

- The Department will maintain conservation requirements initiated by the Second Management Plan that were effective and expand them where appropriate. The Department will recognize existing conservation efforts in setting Third Management Plan conservation standards.

- The Department will provide financial and technical assistance to implement water conservation, augmentation, monitoring, and recharge measures.

- The Department will encourage development of infrastructure that will allow use and storage of renewable water supplies.

- The Department will expand public assistance and public education efforts to reach a larger portion of the public.

- The Department will provide incentives, as appropriate, to encourage water conservation and water augmentation activities consistent with water management objectives.

- Department staff will actively participate in regional and local water management planning and cooperative projects.

- The Department will collect, analyze, and maintain data in order to provide the information necessary to identify water management issues and trends and to propose appropriate and timely solutions.

- The Department will endeavor to enhance water quality management efforts in order to preserve the quality and quantity of water available for existing and future needs.

- The Department will encourage recharge activities in areas where storage of renewable supplies will be beneficial from a water management perspective. Management of both storage and recovery activities will be required to protect future water supplies and the storage capacity of the aquifers.

- The Department will encourage coordination between the agencies that affect water policy, particularly the ACC and ADEQ.

- The Department will work with the state's political leadership, water users, and the public to identify and develop the tools and additional statutory authority necessary to achieve water management goals and objectives.

1.5.3 Third Management Plan Development Process

Development of the Third Management Plan has involved data collection and analysis, issue identification, and program development. Public participation has been an important component of the process throughout the development of the Third Management Plan.

1.5.3.1 Program Development and Implementation

This Third Management Plan is the result of a three-staged work effort which began in 1994. The first stage involved data collection and analysis culminating in development of a "State of the AMA" (SOAMA) report which was widely distributed. In the second stage, issues identified in the SOAMA report and raised by the community were addressed in issue papers describing the issue and identifying recommended alternatives. The third stage involved developing recommended alternatives into program concepts and, ultimately, into the program chapters and legal requirements presented in the Third Management Plan. Throughout preparation of the Third Management Plan, public input and technical research have been used to identify issues, objectives, and solutions.

1.5.3.2 Public Participation

Multiple levels of public input have been used in development of the Third Management Plan. The Code established a five-member GUAC for each AMA. The GUAC members are appointed by the Governor to represent the groundwater users in the area and advise the director of the Department and the AMA director on matters relating to water management within the AMA. Santa Cruz AMA staff met regularly with the GUAC to obtain member opinions and recommendations on all components of this plan. The GUAC meetings were open to the public and interested groups and individuals communicated their views and recommendations in this forum. Pursuant to A.R.S. § 45-421(1), the GUAC must comment on the proposed plan before promulgation.

Technical review was provided by committees comprised of experts on water quality, water resources, and water budgets. In the Santa Cruz AMA, the technical review of the management plan was also performed through the GUAC. Across the five AMAs, public comments were received in meetings with interested parties and during and following presentations to civic organizations and the general public. The Department's philosophy is to maximize public input on the content of the management plans to ensure that the public's concerns and ideas are adequately incorporated.

Additional public input is obtained through formal public hearings conducted after the proposed plan is completed. A.R.S. § 45-570. In these hearings the Department presents information in support of the plan and obtains comments regarding the plan. Before the plan is adopted, the director of the Department may revise the plan and must prepare a written response to the written and oral comments submitted as part of the hearings process.

1.6 THIRD MANAGEMENT PLAN CONTENT

The Third Management Plan addresses water conservation, water augmentation, water quality, and related water management programs for the years 2000 to 2010 and comprises the following five primary elements:

- Assessment of the status of water supplies and demands in the AMA
- Mandatory conservation and monitoring requirements for agricultural, municipal, and industrial water users and water distribution systems
- Water supply augmentation and recharge program
- Water quality assessment and management program

- Conservation, augmentation, and monitoring assistance program

Statutory guidelines provided in A.R.S. §§ 45-566, 566.01 and 566.02 direct that the following components be included in the Third Management Plan:

- New irrigation water duties for each farm unit
- An alternative agricultural program for Irrigation Grandfathered Right holders
- Additional reasonable reductions in per capita use to those specified in the Second Management Plan
- A Non-Per Capita Conservation Program for municipal providers
- Appropriate conservation measures for individual users on municipal systems
- Conservation or rate-of-use requirements for deliveries of untreated water
- Reasonable conservation requirements for small municipal providers
- Additional economically reasonable requirements for water distribution by cities, towns, private water companies, and irrigation districts
- Conservation requirements for industrial uses based on the use of the latest commercially available conservation technology consistent with reasonable economic return
- A program for additional augmentation of water supplies by AMAs, if feasible, including incentives for artificial groundwater recharge
- Cooperation with the Arizona Department of Environmental Quality in developing a groundwater quality assessment for the AMAs including suggestions for groundwater protection
- A program for conservation assistance to water users
- At the discretion of the director, a program subsequent to January 1, 2006 for the purchase and retirement of grandfathered groundwater rights
- A determination of historic annual net recharge for AMAs in which a groundwater replenishment district is located
- For the Santa Cruz AMA, an evaluation of the potential impact of that AMA's Third Management Plan on the Tucson AMA
- For the Tucson, Phoenix, and Pinal AMAs, advice to the Arizona Water Banking Authority (AWBA) regarding whether storage in the AMA would help achieve the management goal, where such storage should occur, and whether extinguishment of long-term storage credits would help to achieve the management goal for the AMA.

The Department describes in the Third Management Plan the water management issues emerging in the AMA and what programs or changes in statute or rule may be required to resolve these issues. Because the Santa Cruz AMA was created recently, several programs or statute/rule changes may need to be developed during the third management period in order to resolve water management issues at the AMA and local level.

Information is provided throughout the Third Management Plan to explain its development, educate interested individuals regarding the water management issues facing the AMA, and provide information useful in developing future water management policies for the AMA. Throughout the document there are significant policy statements regarding how the Department proposes to manage the AMA's water supplies pursuant to the provisions of the Code and the provisions of the Third Management Plan. The regulatory requirements for water users and water distribution systems are printed in italics for easy reference and are located at the ends of chapters 4 and 5; after each industrial use sector in Chapter 6; and in chapters 8 and 9.

1.7 EMERGING CHALLENGES FOR THE SANTA CRUZ AMA

The 1994 legislation establishing the Santa Cruz AMA called for the development of a comprehensive and well-balanced management strategy reflecting the unique goal and nature of the AMA. The principal factors making the Santa Cruz AMA unique include: the goal of the Santa Cruz AMA community to protect the limited water resources of the AMA as well as the diverse habitat along the Upper Santa Cruz River, the international nature of the water management issues facing the region, and the need for coordinated water management of surface water rights and groundwater rights to meet the management needs of the area. Challenges facing the AMA include:

- the development, expansion, and maintenance of a database allowing improved understanding of the fluctuating hydrologic conditions present in the AMA
- the development of programs to assure sustainable water supplies
- the settlement of surface water rights claims
- the facilities planning process for the treatment and disposition of wastewater from both sides of the international border
- the protection of core aquatic and riparian habitats
- the sustenance of a healthy economy

Regulatory components include several interrelated programs, such as:

- the Third Management Plan, containing conservation requirements for agricultural, industrial, and municipal users; criteria for assessing the impact of new non-exempt wells on safe-yield and local water tables; and incentives for recharge
- well spacing rules for the impact of new non-exempt wells on the water supplies of current well owners (potentially amended to include criteria specific to the AMA)
- the AWS Rules (amended to include criteria specific to the AMA)
- recharge statutes (potentially amended to include criteria specific to the AMA)
- a surface water rights decree establishing the validity, priority, and quantification of water right claims

Non-regulatory components are also interrelated and include the following:

- a water district or other entity expressly charged to ensure the acquisition and continuous availability of water supplies needed to meet the needs of the AMA water users while maintaining consistency with statutory goals and management objectives
- ongoing hydrologic investigations including the Department's development of surface water and groundwater flow models to be used for projecting the impact of changing supply and diversion conditions and for long-range planning
- an agreement with Mexico regarding the development and management of wastewater treatment facilities and the disposition of the treated water

1.8 CONCLUSION

We have at this time a unique opportunity to resolve several important matters while developing a sound management program for the AMA. Creation of a successful program will depend on the cooperation and commitment of all participants - government entities at local, state, federal, and international levels; water users; water providers; and the community - in refining goals, developing tools, and implementing program features. This complex effort will require several years to complete. The Department is firmly committed to working with interested parties and to dedicating considerable resources to get the job done. We anticipate that several milestones or interim targets will need to be set along the way as we progress.

CHAPTER

2

Overview of Water Resources

2.1 INTRODUCTION

The Santa Cruz Active Management Area (AMA) covers 716 square miles in the Upper Santa Cruz Valley River Basin. It is principally concentrated around a 45-mile reach of the Santa Cruz River from the international border to the Continental gaging station, located a few miles north of the Santa Cruz/Pima County line. The drainage area of the Santa Cruz River upstream from Continental is about 1,680 square miles. From its headwaters in the San Rafael Valley, the river flows southward into Mexico, flows for 25 miles through Mexico, bends northward, and enters Arizona again five miles east of Nogales. Surface water flow within the Santa Cruz AMA is extremely variable (Putman, et al., 1983). The river can be generally characterized as ephemeral or intermittent with some perennial reaches. An effluent-dominated perennial reach exists immediately downstream from the Nogales International Wastewater Treatment Plant (NIWWTP).

Major tributaries which feed the Santa Cruz River within the Santa Cruz AMA include Nogales Wash, Sonoita Creek, and Sopori Wash, as well as Peck, Agua Fria, and Josephine Canyons. Sonoita Creek and Nogales Wash are the largest tributaries to the Santa Cruz River in the AMA.

The Santa Cruz AMA watershed has been subject to dry and wet climatic cycles. The longest dry period included several years up to 1954. Figures 2-1 and 2-2 show the long-term annual precipitation at Tumacacori, Arizona and Nogales, Arizona, respectively. In Tumacacori, the average annual rainfall from 1948 to 1995 was 15.7 inches. Nogales averaged 18.4 inches of precipitation from 1953-1995. Fluctuations in wet and dry cycles have generally occurred over 30 year intervals. The shallow depth of its aquifers and the high transmissivity of the alluvium make many portions of the Younger Alluvium of the Santa Cruz River responsive to precipitation events and susceptible to droughts. Figure 2-3 graphs the surface flow at the United States Geological Survey (USGS) streamgage at Buena Vista at the southern edge of the AMA and water level changes at nearby Santa Fe Ranch and the City of Nogales Highway 82 wellfield.

FIGURE 2-1
SANTA CRUZ ACTIVE MANAGEMENT AREA

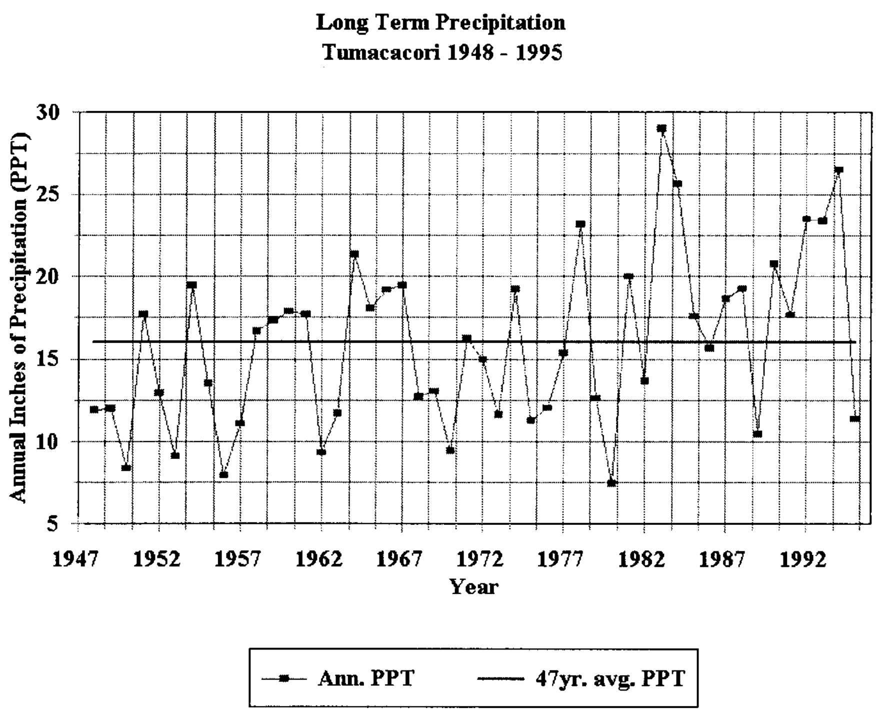
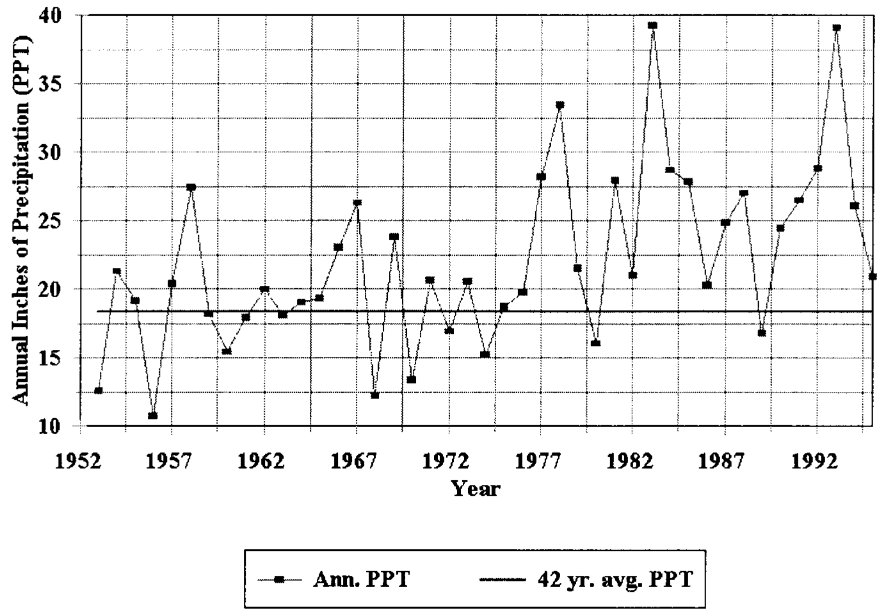


FIGURE 2-2
SANTA CRUZ ACTIVE MANAGEMENT AREA

Long Term Precipitation
Nogales 1953 - 1995



More detailed information on factors affecting water supply conditions in the AMA and a description of available supplies are discussed in the following sections:

- Data sources
- Geologic and aquifer characteristics
- Hydrologic conditions
- Hydrologic analysis
- Availability and utilization of renewable supplies

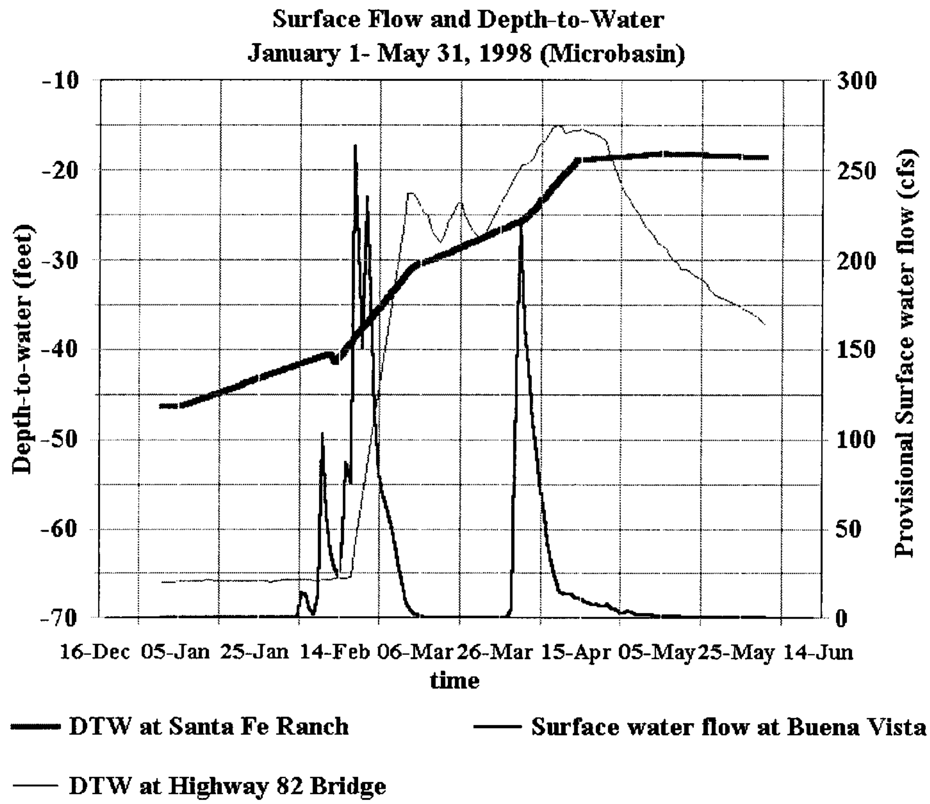
2.2 DATA SOURCES

Data sources describing hydrologic conditions in the AMA are available from the Arizona Department of Water Resources (Department), other state agencies, federal agencies, and water utilities. Some of the major data sources are described below.

2.2.1 Arizona Department of Water Resources Basic Data and Hydrology Divisions

Beginning in 1997, the Department started collecting monthly streamflow measurements along the Santa Cruz River. Water levels are also measured monthly at about 40 index well locations. Data collected is being used in developing a hydrologic computer model for the Santa Cruz AMA. Continuous, regular monitoring provides information on seasonal change that cannot be easily or accurately deduced from less frequent data gathering. The continuation of monitoring activities such as these will ensure that the Santa Cruz AMA has current information available to support its water management efforts.

FIGURE 2-3
SANTA CRUZ ACTIVE MANAGEMENT AREA



2.2.2 Arizona Department of Water Resources Computer Model

Dual water management goals guide the Santa Cruz AMA. Safe-yield conditions must be maintained, and long-term declines in local water tables must be prevented. In order to evaluate the achievement of these goals, a very good technical understanding of the hydrologic system of the basin is needed. The Department's Hydrology Division is developing a regional hydrologic model that will provide input in understanding and managing the water resources of the Santa Cruz AMA.

The Santa Cruz AMA hydrologic model will be used as a tool to help explore water management alternatives for the Santa Cruz AMA for the third management period (2000-2010). The model will support the Assured Water Supply Program (AWS Program) by helping to identify the physical availability of water resources. The model may also address issues such as the effect of diminished availability of effluent on the riparian system and other water users downstream of the NIWWTP.

The hydrologic model of the Santa Cruz AMA will provide:

- a regional look at the hydrologic system
- a tool to integrate the effects of numerous stresses on the hydrologic system
- a tool to explore alternative management concepts
- a tool to educate Department staff and the public
- a database containing hydrologic information to support other studies, and programs (AWS)

Questions that the model would be expected to help answer are:

- What effect will various levels of municipal and industrial growth have on the goals of the AMA? How much growth can occur under safe-yield conditions?
- What effect would retirement of agricultural land have on the maintenance of AMA goals?
- Will recharge programs be effective in mitigating undesired effects due to water withdrawals? Would such programs allow higher levels of development? If so, where would recharge projects be useful?
- What are the probable effects of a prolonged drought on Santa Cruz AMA hydrologic conditions?
- Do opportunities exist for a better use of the binational watershed?

It is not expected that the model will provide sufficient spatial or temporal definition to be able to answer questions on the effect of small, single wells due to the regional nature of the model and the lack of data. The Department does not have the authority to collect water withdrawal information from wells with pump capacities of 35 gallons per minute (gpm) or less.

The Santa Cruz AMA hydrologic modeling process began in 1997 with Phase 1, data collection and review of prior studies. A groundwater flow model has been built using the USGS model code MODFLOW. Currently, the model is in the calibration phase where the goal is to replicate historical water level conditions. Once the model has been calibrated it will be used to evaluate future water management scenarios.

The model will address questions concerning meeting the AMA water management goals. The model will also assist in understanding the consequences of effluent recharge downstream from Rio Rico, interactions between continued water demand, varying river flows, the changing riparian system, and the effects of future growth on the hydrologic system.

The hydrologic system of the basin is heavily dependent on the highly variable surface flow of the Santa Cruz River and larger tributaries such as Sonoita Creek and Sopori Wash. These types of hydrologic conditions call for a model that deals well with seasonality and annual fluctuations in total precipitation as well as the intensity and duration of precipitation, along with interactions between different hydrologic segments and alluvial components.

2.2.3 Other Agencies and Reports

The Santa Cruz AMA model will incorporate data provided by other agencies as well as data collected and analyzed specifically for the model. Government entities in Mexico have graciously provided data on the Santa Cruz River watershed across the International Boundary. Additional data has been collected by the Department within Santa Cruz county to assist in the technical analysis necessary for managing water resources in the AMA.

The Department has also conducted a study to examine the historic riparian system of the Santa Cruz River. Studies of effluent recharge and riparian use are important to properly understand the hydrology of the Santa Cruz AMA because effluent recharge comprises a large and relatively consistent input to the hydrologic system and because the riparian habitat is the largest water demand in the basin. In addition, geologic studies by the Department will better define the hydrogeology of the Santa Cruz AMA.

2.3 GEOLOGIC AND AQUIFER CHARACTERISTICS

Basin-fill sediments along the Santa Cruz River north of the City of Nogales to Amado form three aquifer units. Listed in ascending order, they are: the Nogales Formation, the Older Alluvium, and the Younger Alluvium. Both alluvial units are generally unconfined, hydraulically connected, and yield water to wells, although the Older Alluvium aquifer does exhibit semi-confined and confined conditions in some places, most notably in Potrero Creek. The Nogales Formation is not generally considered an aquifer, although local exceptions may occur. It is better referred to as "hydrologic bedrock." Figure 2-4 displays the geologic units which are located in the Santa Cruz AMA.

2.3.1 The Nogales Formation

Although few wells penetrate the Nogales Formation, it is believed to underlie the Older Alluvium in many parts of the Santa Cruz AMA. The Nogales Formation generally underlies the basin and is composed of well-consolidated conglomerates with some interbedded volcanic tufts and is estimated to be at least 5,000 feet thick (Simons, 1974). The Nogales Formation generally has poor water bearing characteristics and has not been widely developed as a source of water. Groundwater occurs primarily in fracture zones and unconsolidated layers within the formation. Well yields of several hundred gallons per minute have been obtained from this formation; however, average yields are less than 30 gpm.

2.3.2 The Older Alluvium

The Older Alluvium consists of locally stratified lenses of boulders, gravel, sand, silt, and clays with cemented zones or caliche (Anderson, 1956; Schwalen and Shaw, 1957; Putman, et al., 1983). Although this basin-fill alluvium stores large amounts of water and is the most extensive geologic unit within the Santa Cruz AMA, its transmissivity is generally low and well yields are often small. The thickness of the Older Alluvium in the Santa Cruz AMA ranges from a few feet along the mountain ranges to about 1,000 feet or more in the north-central portion of the AMA.

2.3.3 The Younger Alluvium

The Younger Alluvium, sometimes referred to as the floodplain or stream alluvium, is present along the Santa Cruz River and some of its larger tributaries. Depth ranges from 40 to 150 feet and floodplain width varies from about 0.3 miles at the border with Mexico to 2.5 miles near the northern boundary of the Santa Cruz AMA. It is comprised of unconsolidated sands, gravels, and boulders and is usually more coarse grained than the Older Alluvium (Schwalen and Shaw, 1957). These stream channel and floodplain deposits have large hydraulic conductivities and, consequently, are the most productive and widely used aquifer in the region. Some wells tapping this aquifer yield over 1,000 gpm.

A majority of the water withdrawn from wells in the Santa Cruz AMA originates from the Younger Alluvium. Generally, the thickness and width of the Younger Alluvium increases in a northerly direction following the path of the Santa Cruz River.

2.4 HYDROLOGIC CONDITIONS

Hydrologic maps showing water level changes over different periods of time generally provide insights into trends in water storage and water level recovery. The highly seasonal nature of surface water flow, the high transmissivity of the Younger Alluvium of the Santa Cruz River, and the discharge of effluent from the NIWWTP complicate the analysis of water level change and make water level change maps less useful in the Santa Cruz River alluvium. To assist Santa Cruz AMA water management efforts, the hydrologic maps included show the location of wells with a long history of water level measurement. Hydrographs of these wells showing seasonality and annual fluctuations in water levels associated with natural components of the system follow the map and provide information on long and short-term water level trends. The hydrographs provide useful information about past and present hydrologic conditions in the Santa Cruz AMA. Figure 2-8 shows the locations of hydrograph data.

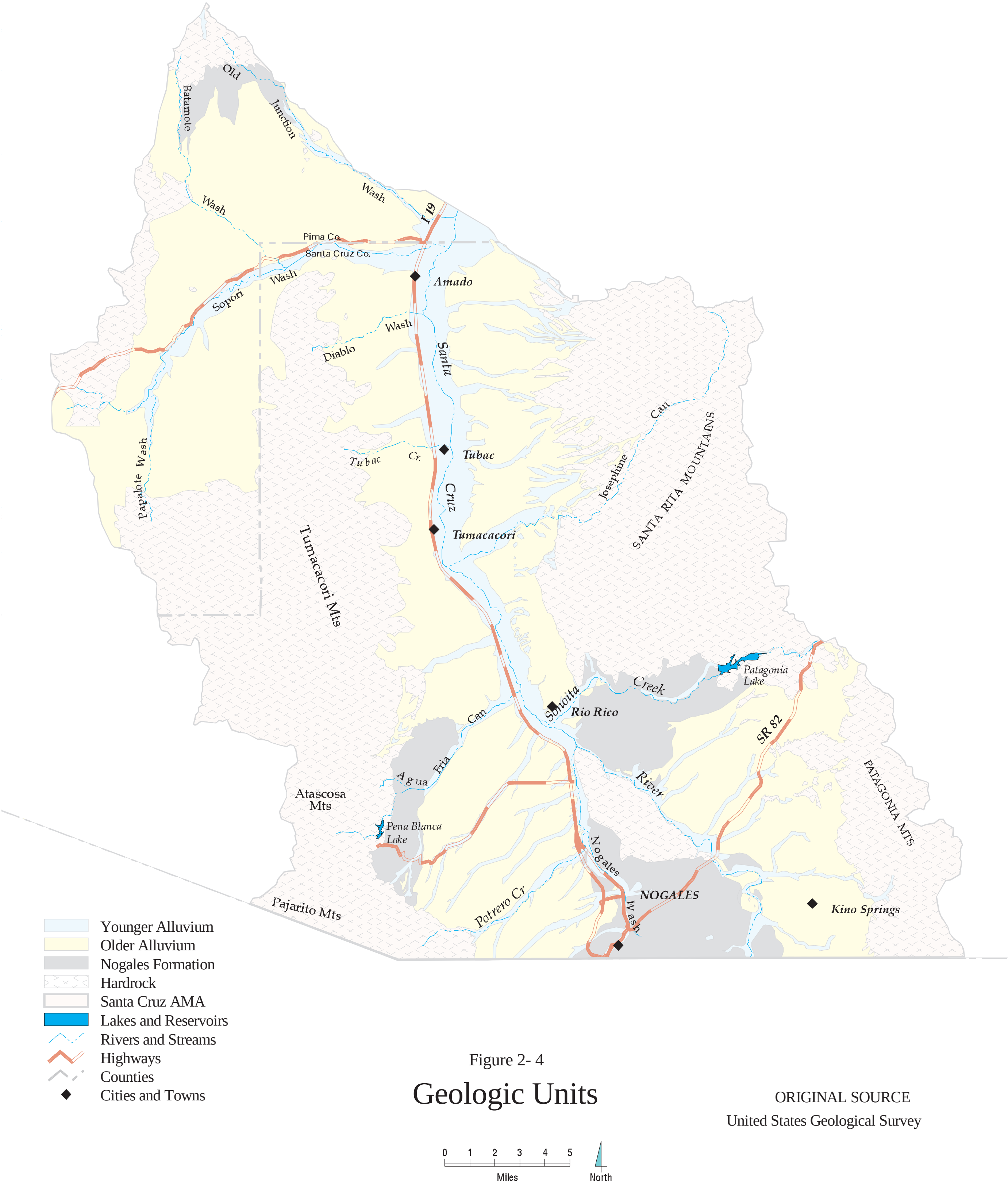


Figure 2- 4

Geologic Units

ORIGINAL SOURCE
United States Geological Survey

Water level elevation maps show the elevation of the water table above mean sea level. The general direction of groundwater flow in an aquifer is indicated by the orientation of the contours on a water level elevation map. A general rule of thumb when interpreting these maps is that groundwater flows from higher elevations to lower elevations, and the direction of flow is generally at right angles to the water level elevation contours. Figure 2-5 depicts Santa Cruz AMA water level elevations from 1952, while Figure 2-6 displays water level elevations in 1982 and Figure 2-7 depicts the 1995 water level elevations.

2.4.1 Santa Cruz River

2.4.1.1 Overview

Changes in human activity have changed flow characteristics along the Santa Cruz River. At the beginning of the century, water withdrawals in the AMA were characterized by direct surface water diversions from the river channel. A major change occurred during the 1920s and 1930s, particularly in the Rio Rico area, when irrigation wells withdrawing water from the subflow zone of the Santa Cruz River gradually replaced direct surface water diversions (Halpenny, 1998).

Pumping stations started withdrawing water along the Santa Cruz River near the Nogales area (Ambos Nogales). Wastewater generated from Ambos Nogales was discharged into the Nogales Wash and subsequently flowed back into the river. The later addition of groundwater from the Potrero wellfield to the municipal supply added another supply component to the effluent generated (Halpenny, 1998).

In 1951, a small wastewater treatment plant began operation for the City of Nogales, Arizona handling limited quantities of raw sewage. In 1972, the NIWWTP began treating the increasing volume of wastewater from Nogales, Arizona and from Nogales, Sonora. The resulting effluent is discharged into the Santa Cruz River.

Water levels downstream from the NIWWTP have increased in part due to effluent discharge. A nearly perennial reach has developed between the NIWWTP and Tubac, although there are locations where the channel is dry in the summer along this reach. However, water levels along the effluent-dominated perennial reach have gradually stabilized in recent years. The riparian habitat along the Santa Cruz River has expanded due to effluent discharge and the recent higher than normal precipitation and natural surface flow. As the aquifer deepens close to the Tucson AMA boundary, the effect of effluent discharge on water levels appears to diminish.

Increased demand has resulted from the large population increase over the past decade in Ambos Nogales. Recent economic growth along the border has increased municipal water use and placed a greater burden on the small, isolated aquifers along the Santa Cruz River upstream from the NIWWTP and at Potrero Creek municipal wellfield. Future inflow into the Santa Cruz AMA could be reduced if the population expansion continues at its current rate in Nogales, Sonora. This situation is complicated by the local hydrogeology, which is susceptible to short-term drought to a varying extent throughout the Santa Cruz AMA.

As noted previously in the chapter, surface flow within the Santa Cruz AMA is extremely variable and can be characterized generally as ephemeral or intermittent with some perennial reaches. Perennial reaches in this area result from either sub-surface geologic barriers which force water to the surface, or effluent discharge from the NIWWTP. Currently, however, the only perennial reach along the Santa Cruz River is the effluent-dominated segment which extends about 12 miles downstream from the NIWWTP discharge site.

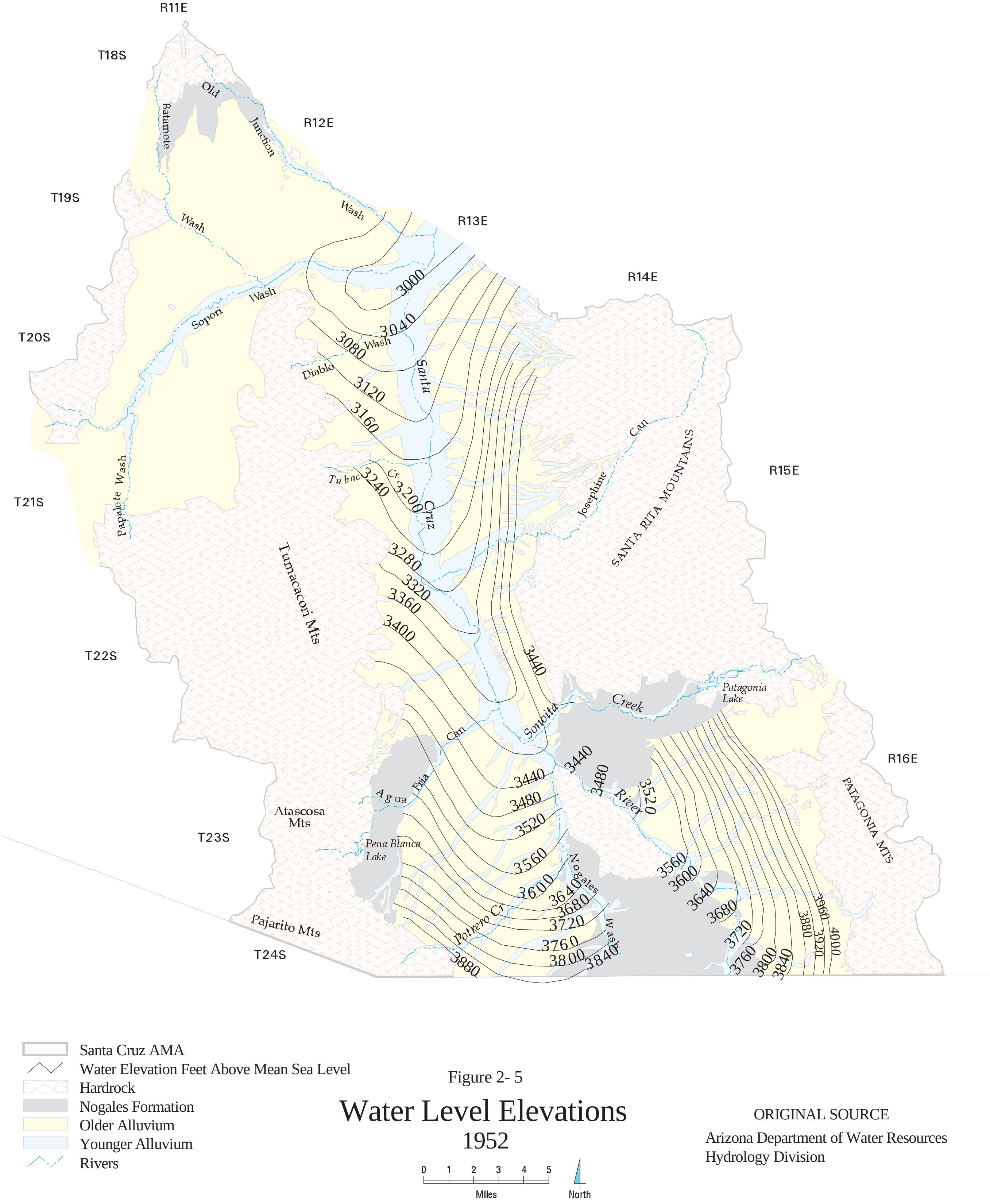
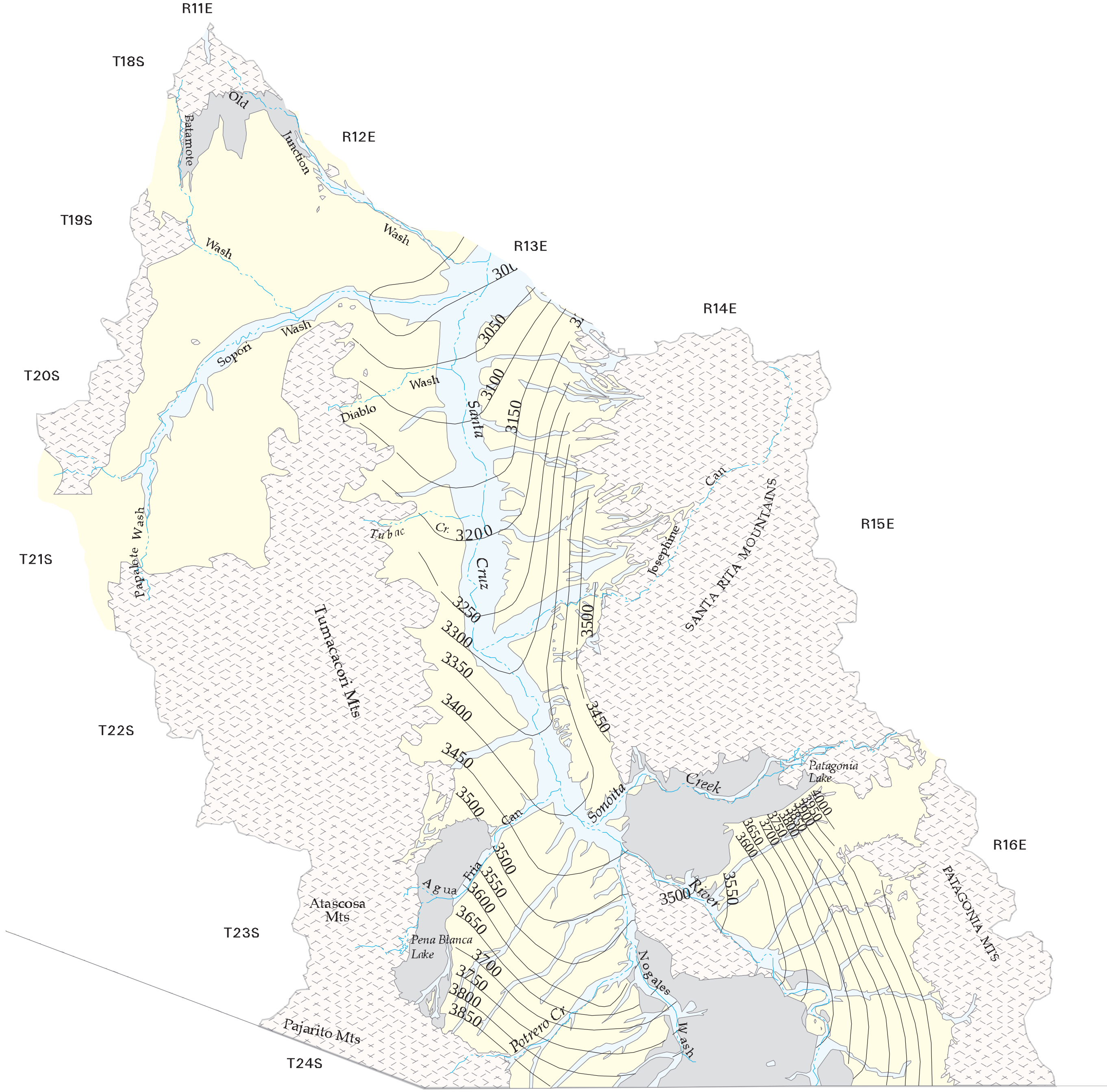


Figure 2- 5

Water Level Elevations

1952

ORIGINAL SOURCE
Arizona Department of Water Resources
Hydrology Division



Santa Cruz AMA
Water Elevation Feet Above Mean Sea Level
Hardrock
Nogales Formation
Older Alluvium
Younger Alluvium
Rivers

Figure 2- 6

Water Level Elevations

1982

0 1 2 3 4 5
Miles
North

ORIGINAL SOURCE
Arizona Department of Water Resources
Hydrology Division

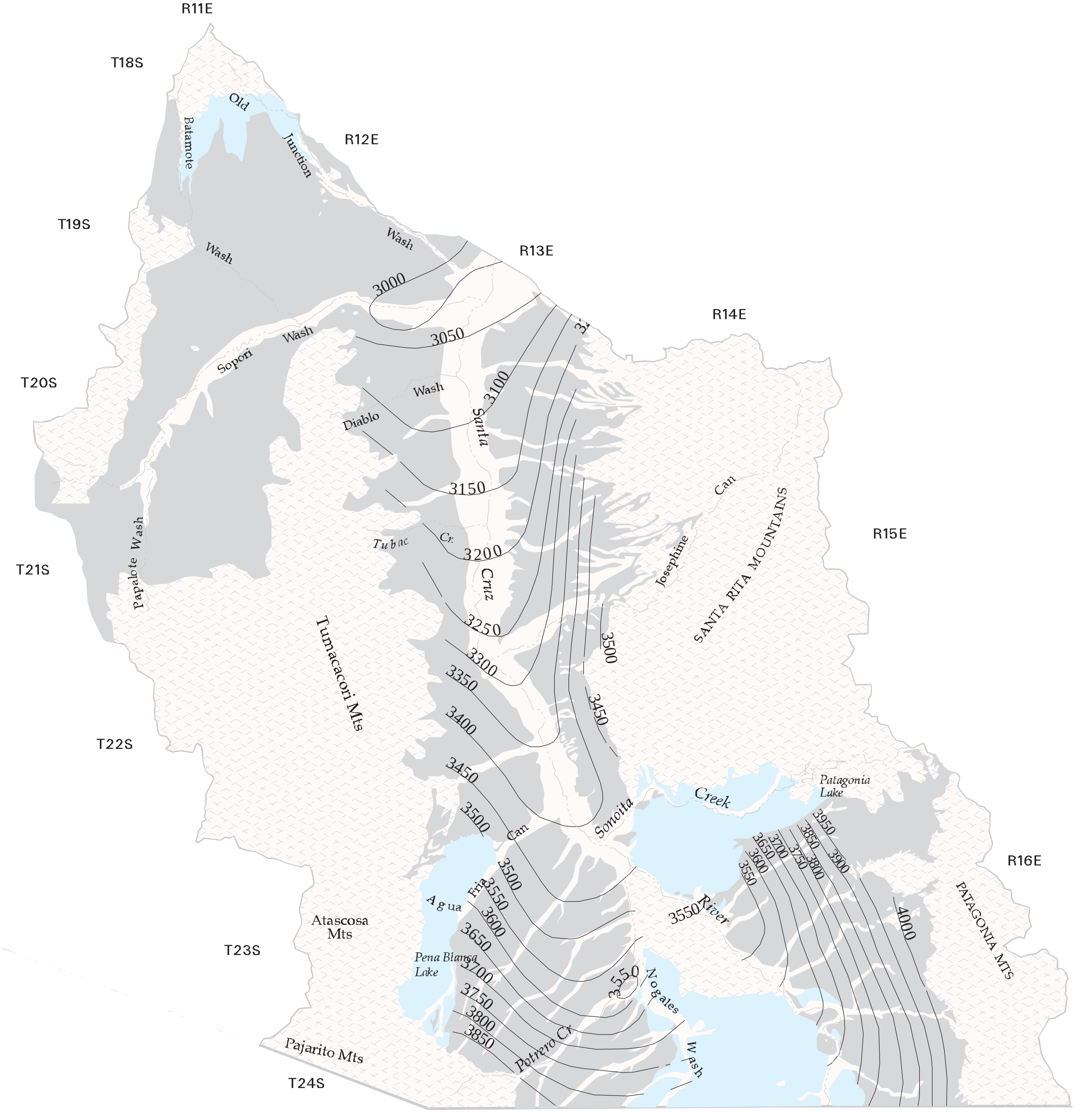


Figure 2- 7

Water Level Elevation

1995

ORIGINAL SOURCE
Arizona Department of Water Resources
Hydrology Division

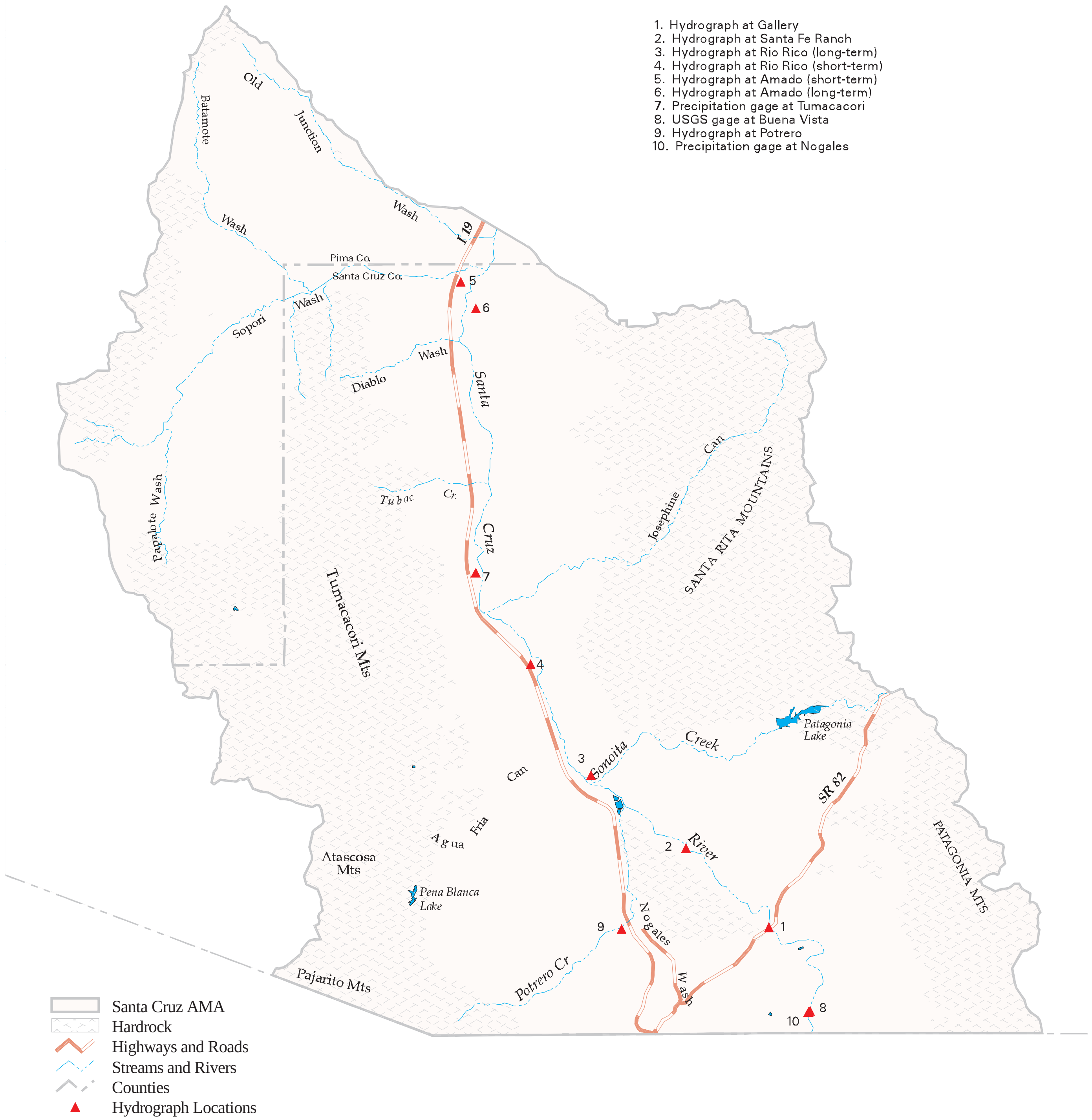


Figure 2- 8

Hydrograph Locations

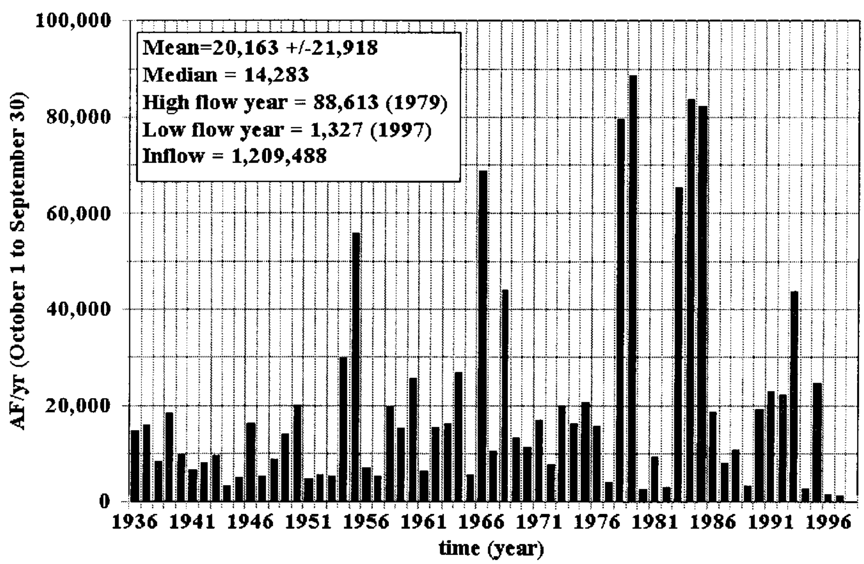
ORIGINAL SOURCE

Arizona Department of Water Resources
Geographic Information System

The Santa Cruz River serves as a major source of recharge for the Younger Alluvium. As long as streamflow is available, water levels in the Younger Alluvium remain relatively constant. When water withdrawals exceed recharge from surface flow, water levels in the Younger Alluvium decline. Figure 2-9 shows the variability in surface water flow at the USGS Buena Vista gage. Between 1935 and 1997 considerable fluctuations in annual streamflow have occurred. Only 1,327 acre-feet of flow was measured at the Buena Vista gage in 1997. Whereas in 1979 over 88,000 acre-feet of flow was recorded. This tremendous range of values results in a wide range in the amount of natural recharge that occurs within the Younger Alluvium in any given year. The median flow for the period from 1935 to 1997 was 14,283 acre-feet, but using this value to predict future flows or expecting this flow to occur year after year is not a sound assumption. NIWWTP effluent discharge and surface runoff along several tributaries of the Santa Cruz River, most notably Sonoita Creek and Sopori Wash, also contribute recharge to the Younger Alluvium.

FIGURE 2-9
SANTA CRUZ ACTIVE MANAGEMENT AREA

Surface Water Flow at Buena Vista
U.S.G.S. Gage 1935-97 (Water year)



The Department's water management efforts in the Santa Cruz AMA recognize the binational character of the subbasin. As water management issues are resolved on this side of the international border, Mexican officials are also dealing with problems of water supply, distribution, and demand. As solutions are implemented in Mexico, the volume of effluent treated at the NIWWTP could change. In addition, inflow from the Santa Cruz River could change based on water management efforts across the international line. The Department's water management efforts must be strong enough to ensure a continuous water supply is available for current and committed demands in the Santa Cruz AMA, while at the same time being flexible enough to adjust for changes in the water management efforts of Mexico.

2.4.1.2 International Boundary to NIWWTP

Upstream from the NIWWTP the Santa Cruz River flows through a series of four microbasins filled with younger alluvial deposits (Halpenny, 1964). Each of these microbasins contain a long, narrow band of alluvium bordered by consolidated rocks on the margins. These microbasins are analogous to four bathtubs arranged in a row. The four microbasins include: (1) the Buena Vista microbasin, which extends from the international border to the Buena Vista Narrows; (2) the Kino Springs microbasin, which extends from the Buena Vista Narrows to the Kino Springs Narrows; (3) the Highway 82 microbasin, which extends from Kino Springs Narrows to the Guevavi Narrows; and (4) the Guevavi microbasin, located between the Guevavi and Eagan Narrows.

Each microbasin receives water at the upstream end and flows out on the downstream end. Water withdrawals from one "tub" will generally only cause water level declines in that specific subbasin and not the others. However, each of the microbasins contains limited storage and can be rapidly overdrafted. Generally, the subflow in this area converges along the river, which indicates that the Older Alluvium, and possibly the Nogales Formation, are hydrologically connected to the Younger Alluvium.

The presence of shallow subsurface bedrock constricts the subflow between adjacent microbasins. This effectively limits the available water storage within an individual microbasin. The depth to the water table in the Younger Alluvium is closely tied to the elevation of the streambed of the Santa Cruz River because flow in the river serves as a principle source of recharge. Periods of above normal precipitation and runoff serve to maintain or replenish shallow aquifers. During periods of low flow, however, the microbasins may not be completely recharged.

The thickness of the Younger Alluvium varies from about 40 to 100 feet along this portion of the river. Depth-to-water is generally less than 10 feet below land surface along most of the reach. However, during times of low precipitation and low surface water runoff, this depth may exceed 40 to 50 feet in areas where significant withdrawals occur, such as the City of Nogales wellfield along the Santa Cruz River near State Route 82.

In the microbasin reach of the Santa Cruz River, the natural recharge and discharge of water has been highly variable. To understand water level change in the microbasin reach, seasonal variability versus long-term annual change must be examined. Figure 2-10 shows water level changes at Highway 82 in the microbasin reach in response to seasonal surface flows and water withdrawals. The microbasins are dependent on stream flows to replenish them. Figure 2-11 shows the annual water level change in this location for an extended period of time.

During 1997, water levels in the State Route 82 microbasin dropped to very low levels, due to low surface flow and increased withdrawals to meet municipal demand. The municipal wellfield at this location is one of two primary sources of water for the City of Nogales. Recent drought conditions resulted in a lack of sufficient surface flow recharge to offset withdrawals, resulting in dropping water levels. Winter precipitation in early 1998 has partially replenished this portion of the aquifer. Although water levels recovered by mid-1998 in the area of the Highway 82 wellfield, the overall cycle of depletion and replenishment continues. Changes in pumping regimes and the implementation of additional water conservation measures within water service areas will help to reduce demand from this area and help to maintain the supply.

2.4.1.3 NIWWTP to Tucson AMA Boundary

Downstream of Eagan Narrows and the NIWWTP, in the vicinity of the confluence of Sonoita Creek and Nogales Wash with the Santa Cruz River, the floodplain alluvium of the Santa Cruz River increases in width. Between the NIWWTP and the Josephine Canyon area, the floodplain varies from about 0.8 to 1.2 miles in width. Between Josephine Canyon and Amado, the floodplain also averages about 1.5 miles in width. North of Amado, the floodplain alluvium expands to about 2.5 miles in width at the Santa Cruz AMA northern boundary. Thickness of both the Younger and Older Alluvium increases significantly below this point, particularly in the vicinity of the northern Santa Cruz AMA boundary. Between the NIWWTP and the Pima-Santa Cruz County line the thickness of the Younger Alluvium ranges from about 50 to 150 feet.

FIGURE 2-10
SANTA CRUZ ACTIVE MANAGEMENT AREA

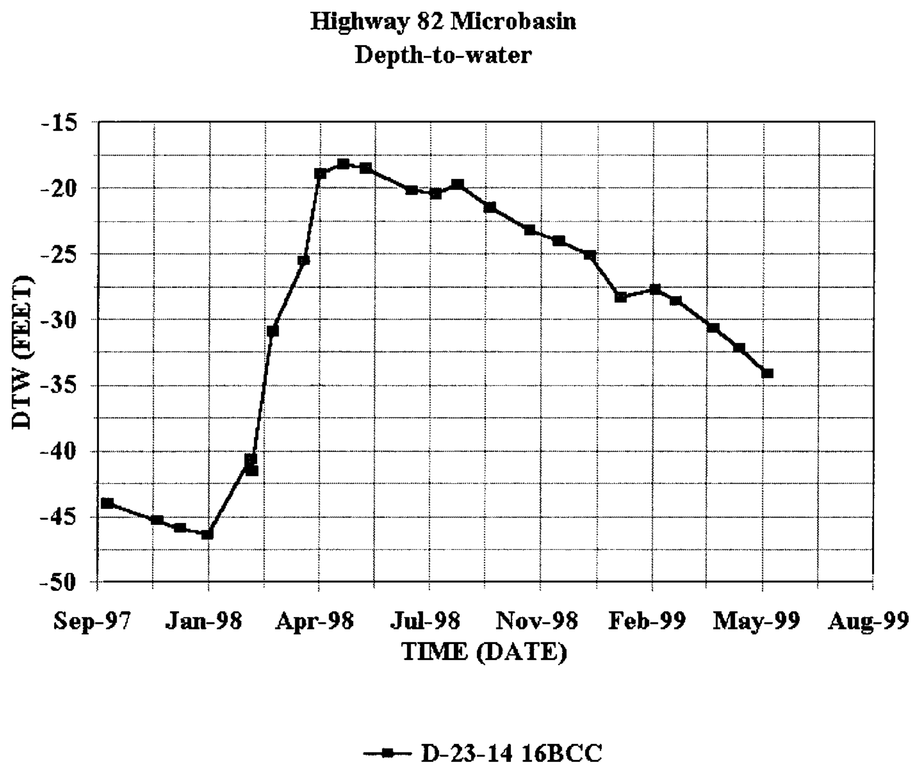
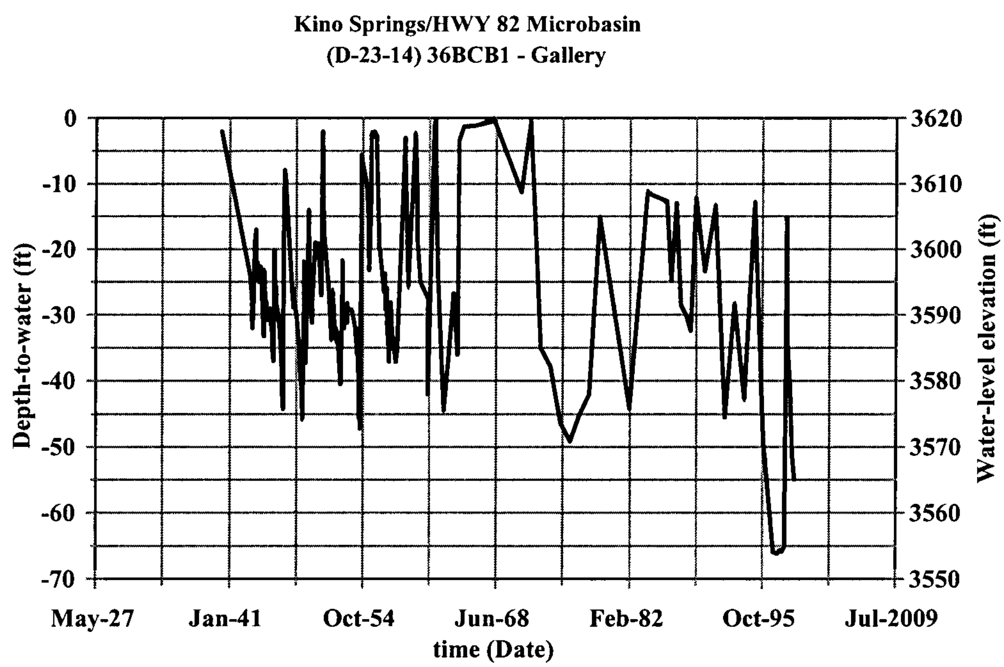


FIGURE 2-11
SANTA CRUZ ACTIVE MANAGEMENT AREA



Mountain front recharge is a major component of recharge to the hydrologic system in this area. The mountain front recharge flows through the regional aquifer toward the Santa Cruz River and eventually joins the subflow in the younger alluvial aquifer. Other recharge components include irrigation seepage, effluent discharge from the NIWWTP, and natural surface water flow (Anderson, 1956; Cella Barr Associates, 1991). A quantification of each recharge component, however, is complicated by the commingled sources of NIWWTP effluent discharge and naturally recharged water along the effluent-dominated perennial reach of the Santa Cruz River.

Recent water level data indicates that the average depth-to-water is less than 10 feet in roughly the first five to six miles below the NIWWTP, to the Peck Canyon area. Depth to water increases to a range of 10 to 20 feet below land surface from near Peck Canyon to the northern AMA boundary.

Hydrographs in Figures 2-12 and 2-13 show seasonal water level changes at Rio Rico and Amado. Long-term hydrographs are also shown for Rio Rico and Amado in Figures 2-14 and 2-15. Although seasonal fluctuations in water levels are characteristic of the Younger Alluvium of the Santa Cruz River, a long-term trend in water levels is observed between Rio Rico and Tubac. Water levels have risen in this area between 1952 and 1982. An additional rise occurred between 1982 and 1995. Recharge from NIWWTP effluent discharge and flood events, and reduced withdrawals for agricultural irrigation are mainly responsible for these water level rises. Water storage in this area is nearly at a maximum and water levels are not expected to increase much higher.

In 1995, depth-to-water ranged from surface flow to as deep as 20 feet below the surface, with the depth to water gradually increasing farther downstream and farther away from the river channel. At Amado, the basin becomes much broader and the alluvial deposits thicken significantly, increasing the local storage potential. Water levels have recovered significantly in this area. However, future development in the Amado area will increase water withdrawals in the area. Consequently, local water levels may again experience declines. The seasonal variation in effluent-dominated flow in the Santa Cruz River further compounds water supply concerns for this area.

2.4.2 Potrero Creek

Potrero Creek is located northwest of the City of Nogales. The City relies on this site as one of its two main water supply sources. The municipal wellfield taps into the regional aquifer, withdrawing water mainly from the Older Alluvium. A cone of depression has developed in the Potrero Creek wellfield. From 1982 and 1995 water level declines in excess of 20 feet have been documented in this area. Hydrogeologic analysis indicates that a dual aquifer system exists in this area. A shallow perched aquifer which rests on top of a semi-permeable clay layer supplies the flow of Potrero Creek and a surrounding wetland area. A deeper basin-fill aquifer supplies the City of Nogales municipal wellfield. At this time, the degree of hydraulic connection between the shallow aquifer and the lower aquifer is uncertain. The lower aquifer is a source of potable water for the City of Nogales. Figure 2-17 is a hydrograph of water level changes over the long-term in Potrero Canyon.

As future growth occurs, the demand at this source will increase. The City of Nogales will probably alternate pumping from this wellfield with pumping at the State Route 82 wellfield to compensate for periods of limited capacity in the microbasin reach.

FIGURE 2-12
SANTA CRUZ ACTIVE MANAGEMENT AREA

Rio Rico: Younger Alluvium
Depth-to-water

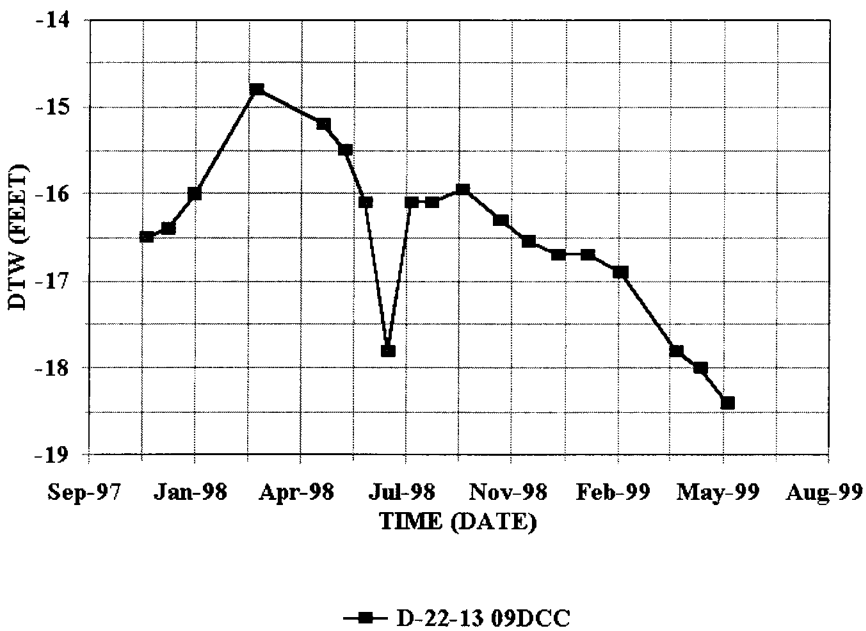


FIGURE 2-13
SANTA CRUZ ACTIVE MANAGEMENT AREA

Amado: Younger Alluvium
Depth-to-water

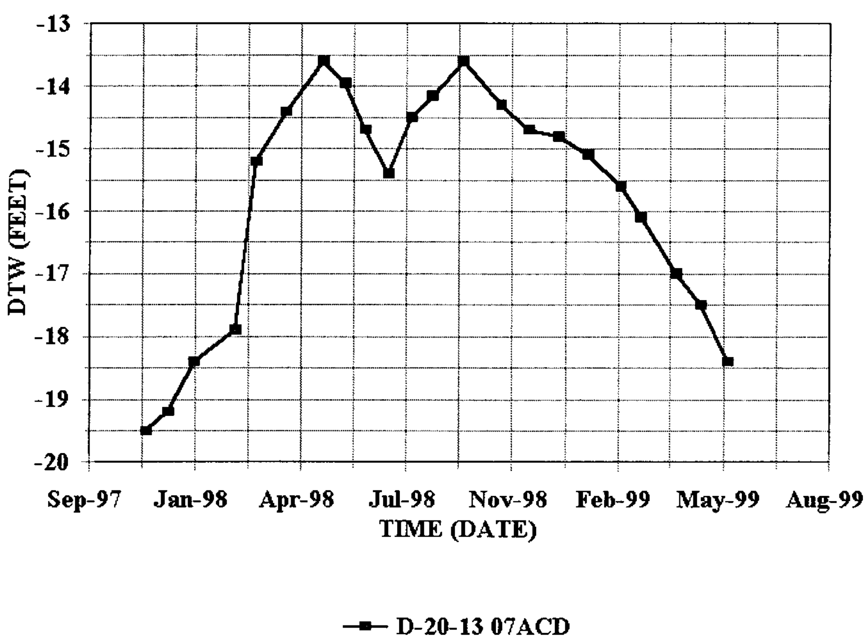


FIGURE 2-14
SANTA CRUZ ACTIVE MANAGEMENT AREA

Rio Rico: Younger Alluvium
(D-22-13) 35DCD

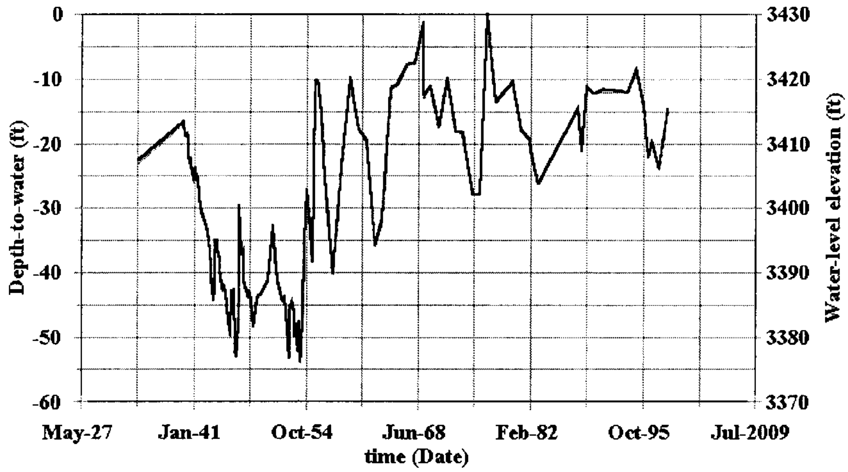
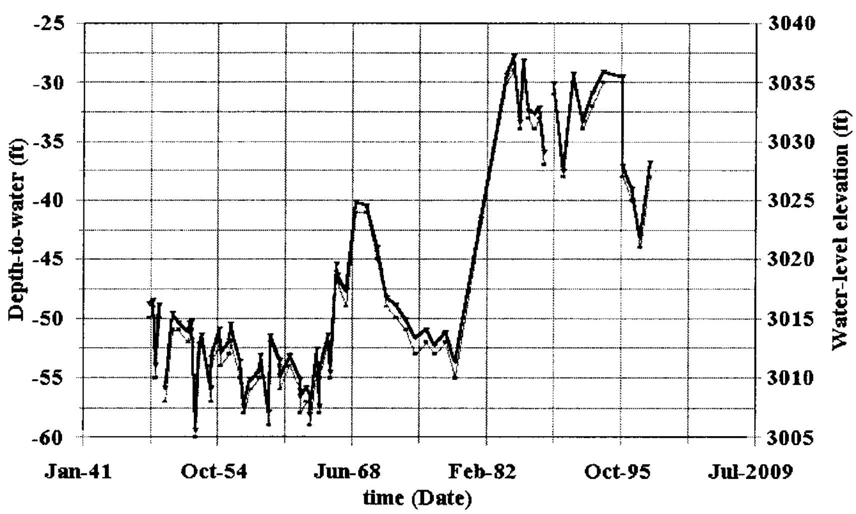


FIGURE 2-15
SANTA CRUZ ACTIVE MANAGEMENT AREA

Amado: Younger Alluvium
(D-20-13) 06CBA



2.4.3 Sopori Wash

The long-term diversion of spring flow and the pumping of water to support cattle grazing and forage crops has created a depression along Sopori Wash west of the confluence with the Santa Cruz River. Current depth to water in this area is 20-60 feet. Closer to the confluence of the wash and the river, water levels have risen 10 to 20 feet since 1982. Depth to water ranged from 100-160 feet in the confluence area in 1995.

2.4.4 Nogales Wash

Depth-to-water along this wash was about 30 feet in 1995. Some of this water level rise may have been attributable to recent leaks in water and sewer lines in Ambos Nogales. Nogales, Sonora has started making improvements to both the potable water and sewer system, repairing leaks and replacing aging infrastructure. System improvements have also occurred in Nogales, Arizona. The results of these improvements may reduce the water level rises observed in Nogales Wash; however, water quality in the wash will be improved, inflow into the NIWWTP will increase, and potable quality supplies will be more efficiently distributed on both sides of the International Boundary.

2.5 WATER SUPPLY COMPONENTS

2.5.1 Introduction

This section provides a description of the water supply components which are included in the water resource analysis contained in Chapter 11 of this plan. This analysis will assist in developing an understanding of the fluctuating supply characteristics of the Santa Cruz AMA and the impact of this condition on the AMA's water management goals. The information contained in chapters 2 and 11 of this plan will be updated as new data becomes available. Demand components are contained in Chapter 3 of this plan.

2.5.2 Water Storage in the Younger Alluvium

An estimate of the volume of water in storage is provided for seven segments of the Younger Alluvium that correspond to specific reaches along the Santa Cruz River at locations where the Department currently measures stream flow on a monthly basis. Water in storage in the Younger Alluvial Aquifer of the Santa Cruz River was estimated by simple tank analysis, a method which is often used by hydrologists in making groundwater storage estimates. Tank analysis is accomplished by making simplifying assumptions regarding the size, shape, and hydraulic properties of the aquifer. It is, of course, important to consider these assumptions when using the estimates for planning purposes.

The volume of water in storage in the Younger Alluvial Aquifer was estimated for each river segment. This was accomplished by first multiplying the measured surface area of Younger Alluvium by the average saturated thickness of Younger Alluvium for each river segment. This calculation provided an estimate of the total volume of saturated Younger Alluvium for each segment. This figure will be refined as additional hydrologic data is collected and analyzed. The resulting estimates of groundwater storage for each segment of the Younger Alluvial Aquifer are listed in Table 2-1. The length and surface area of each segment is also listed in Table 2-1 to further describe the segment. In addition, acres of land associated with current or potential water demand are also listed for information. These acreages include riparian area, irrigated agricultural areas, and Type 1 non-irrigation grandfathered right areas. Figure 2-16 displays the seven segments which were chosen in calculating water storage for Table 2-1.

TABLE 2-1
INVENTORY OF GROUNDWATER STORAGE IN SEGMENTS OF THE YOUNGER ALLUVIAL AQUIFER ALONG THE SANTA CRUZ RIVER
SANTA CRUZ ACTIVE MANAGEMENT AREA

	Segment Description	Length (miles)	Y. Alluvial Area (acres)	Riparian Area (acres)	IGFR Area (acres)	Type 1 GFR Area (acres)	Storage* (acre-feet)
1	United States Border - SR 82	5.9	970	580	140	0	9,000
2	State Route 82 - NIWWTP	7.6	950	690	200	0	9,400
3	NIWWTP - Santa Gertrudis Lane	10.1	5,850	1,380	1,480	0	60,100
4	Santa Gertrudis - Tubac Bridge	3.9	2,980	1,080	940	290	22,900
5	Tubac Bridge - Chavez Siding	2.3	2,300	1,080	10	0	13,600
6	Chavez Siding - Amado	4.6	3,320	690	450	450	20,900
7	Amado - Tucson AMA Boundary	3.1	3,980	750	890	0	23,600
	Totals	**37.5**	**20,350**	**490**	**4,110**	**740**	**159,500**

* Storage volumes are based on a storage coefficient of .17, which may be revised for each segment as the hydrologic model is further refined.

2.5.3 Maximum and Minimum Natural Recharge Components

2.5.3.1 Organization of Inflow Components

An analysis of probable inflow, outflow, and recharge, along with a table of the pumpage by water use sector and estimated riparian water consumption for the Santa Cruz AMA is presented in Chapter 11. This information illustrates the maximum amount of water that may move through the Santa Cruz AMA without being put to use based on current demands, as well as the amount of demand that would need to be offset with water augmentation and replenishment during a minimum flow year, based on current demands. It is important to note that this information reflects overall demand and supply conditions for the AMA as a whole, but in reality, some areas of the AMA may experience critical supply situations during dry years when other portions of the AMA are in a steady state.

Outflows from the Santa Cruz AMA hydrologic system are described in Chapter 3, along with additional system demands. Outflow includes water leaving the AMA as underflow, water below the surface of the land.

Inflows to the system are comprised of both recharge and underflow components. Recharge is derived from four elements including: (1) main channel natural flow, (2) main channel effluent, (3) mountain front and tributary recharge, and (4) incidental recharge from agricultural irrigation. Inflow from underflow includes underflow that enters from Mexico at the Santa Cruz River and west of Nogales.

2.5.3.2 Sources of Data and Range of Estimates

The hydrologic components presented in Table 2-2 have been compiled from a variety of data sources and estimates. This subsection provides more information on the water supply data and estimates.

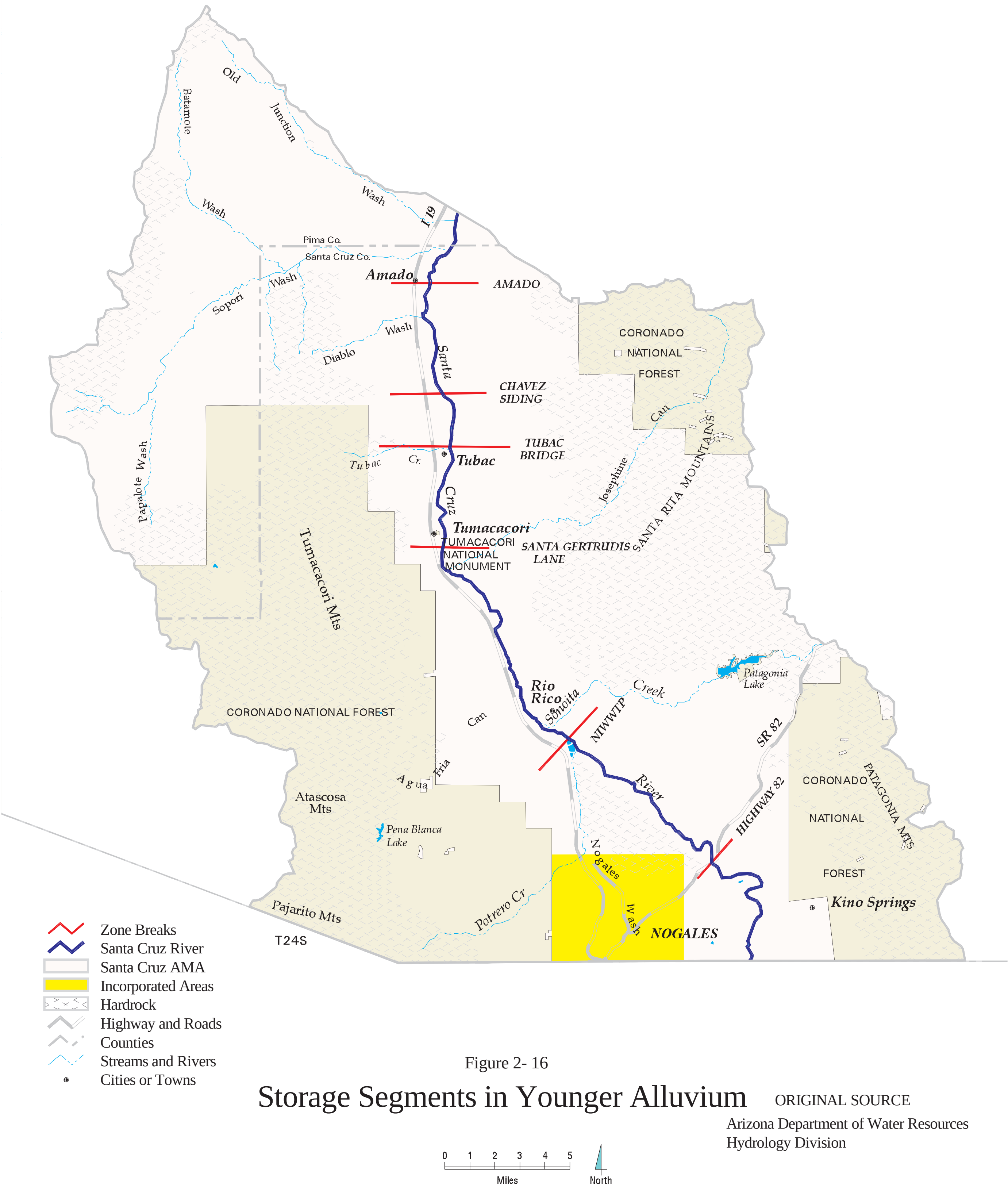
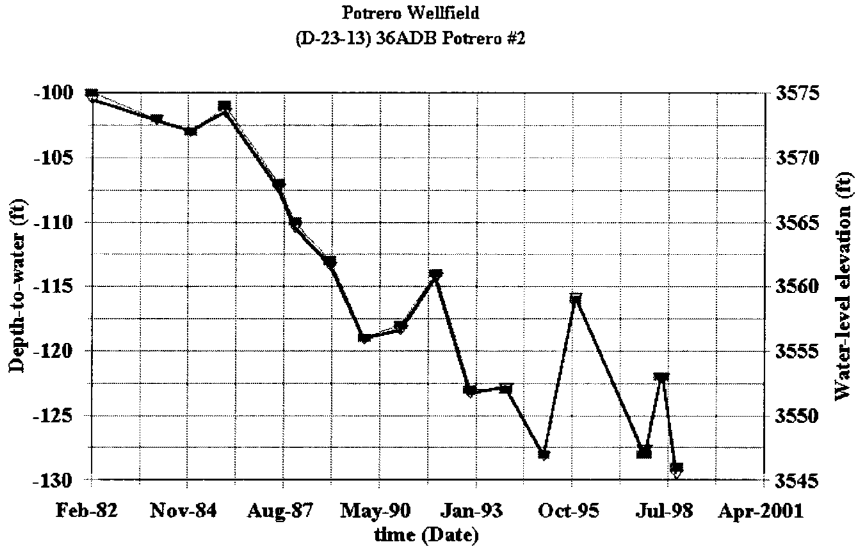


Figure 2- 16

Storage Segments in Younger Alluvium

ORIGINAL SOURCE
Arizona Department of Water Resources
Hydrology Division

FIGURE 2-17
SANTA CRUZ ACTIVE MANAGEMENT AREA



2.5.3.2.1 Effluent Data

Influent and effluent data for the NIWWTP was supplied from annual reports and other data provided by the International Boundary and Water Commission (IBWC). According to the IBWC reports, influent to the NIWWTP varied from about 6,800 acre-feet in 1982 to a high of about 16,700 acre-feet in 1995. Influent in 1996 and 1997 was less than the 1995 figure.

NIWWTP effluent data was obtained for 1992 through 1995. The ratio of reported NIWWTP effluent to influent varies greatly. For example, in 1992 the plant influent was about 14,740 acre-feet, while plant effluent was about 14,860. By contrast, the reported 1995 NIWWTP effluent was about 13,400 acre-feet, or about 80 percent of reported plant influent of 16,700.

Theoretically, evaporation and removal of solids should cause some reduction in the volume of water passing through the NIWWTP. Influent and effluent measurement error may be partially responsible for the wide variation between annual influent-to-effluent ratios. This possibility is further supported by the results of recent stream gaging measurements made by the USGS immediately downstream of the NIWWTP discharge point to the Santa Cruz River. These measurements indicate the plant discharge measuring device may under report effluent discharge by as much as 15 percent (Scott, 1996). The IBWC may subsequently have replaced any meters that were under-registering. Although there appears to be some under reporting of NIWWTP effluent discharge, there was also a large increase in the annual volume of effluent released from the plant during the 1982-1995 period.

2.5.3.2.2 Recharge Estimates

Main Channel Surface Water Flow

Main channel surface water flow is shown for the Buena Vista gage in Table 2-2. The volume of the annual flow that infiltrates depends, among other things, on the available storage capacity in the aquifer, the duration of the flow, and the infiltration rate of each segment of the river.

TABLE 2-2
RANGE IN ANNUAL WATER SUPPLIES
SANTA CRUZ ACTIVE MANAGEMENT AREA
(Figures Rounded to Nearest 100 Acre-Feet)

COMPONENT	RANGE IN ACRE-FEET
INFLOWS	
Main Channel Natural Flow (Santa Cruz River)	1,300 - 88,600
RECHARGE	
Main Channel Effluent	13,400
Major Tributary[1]	5,200 - 41,300
Mountain Front and Minor Tributary	11,400
Incidental (Agricultural and Industrial)	3,900
Total Recharge	**33,900 - 70,000**
UNDERFLOW (estimated)	
Santa Cruz River at Mexico/US Border	100 - 500
West of Nogales Mexico/US Border	200 - 1,200
Total Underflow	**300 - 1,700**
TOTAL INFLOWS	**35,500 - 160,300**

[1] These figures are very rough estimates. As the hydrologic model is further developed, these figures may be adjusted.

Upstream from the NIWWTP main channel surface water recharge is due solely to natural surface flow. Downstream from the NIWWTP it was assumed that recharge from natural flow supplies the difference between the total estimated main channel surface water recharge and the total effluent recharge.

Mountain Front and Tributary Recharge

Estimates of mountain front recharge and minor tributary recharge are included as a supply. The source of these estimates is Osterkamp's 1973 report on groundwater recharge in the Tucson area. It should be noted that the estimates of mountain front and tributary recharge were increased from the Osterkamp estimates to balance the estimated riparian evapotranspiration losses along Sonoita Creek, Nogales Wash, and Sopori Wash. Conceptually, this water is initially recharged along the mountain fronts and minor ephemeral streams which border and transect the older alluvial deposits of the Santa Cruz River Valley. Eventually the groundwater in the Older Alluvium flows into the younger alluvial aquifer. It should be noted that mountain front and minor tributary recharge is equivalent to the regional aquifer recharge mentioned by Scott (1996).

Incidental Agricultural Recharge

Incidental recharge from the over-application of agricultural irrigation water represents a significant source of recharge in some areas. The volume of agricultural recharge is estimated to be 34 percent of the average annual agricultural pumpage. This means that on average, 66 percent of the water applied for agricultural irrigation is used by the plants and 34 percent recharges the aquifer.

The 34 percent recharge or inefficiency factor is also generally supported by the observed ratio between reference crop consumptive use and total pumpage (Scott, 1996). Although this ratio is not a direct measure of agricultural recharge, it is believed to be a close approximation. According to the 1996

University of Arizona study, the calculated irrigation efficiency ranges from about 44 percent to more than 100 percent of the reported monthly agricultural pumpage in 1995. The average ratio of reference crop consumptive use to total agricultural pumpage is about 66 percent for the three summer months when the most intense agricultural pumpage occurred (June-August).

Groundwater Underflow Estimates

The estimates of main channel water underflow into the Santa Cruz AMA at the international border ~~range~~ have been estimated from about 410 acre-feet per year to about 580 acre-feet per year (Halpenny, 1964; Putman et al., 1983). Underflow west of Nogales entering the AMA was estimated at between 200-1,200 acre-feet per year and is derived from 1997 data collected as part of the Department's Santa Cruz AMA Groundwater Modeling Study. The modeling study also estimated underflow at the Santa Cruz River between 100-500 acre-feet per year.

2.6 AVAILABILITY AND UTILIZATION OF RENEWABLE SUPPLIES

2.6.1 Overview

All demand sectors rely on water withdrawn from wells. Indirectly, the combination of effluent, surface water, mountain front recharge, and incidental recharge all contribute to the replenishment of the younger alluvial aquifer. Shallow well pumpage is therefore comprised of water originating from several sources. An AMA-wide water monitoring system may help to identify specific volumes of renewable supplies which are put to beneficial use. However, using information currently available, it is difficult to make the distinction between groundwater and surface water withdrawn from wells.

2.6.2 Renewable Supply Use Trends

2.6.2.1 Central Arizona Project Water

The City of Nogales and Rio Rico Utilities transferred their Central Arizona Project (CAP) allocations, 3,949 acre-feet and 2,683 acre-feet per year respectively, to the City of Scottsdale. Any attempt to transport CAP water to the Santa Cruz AMA would have involved building pipelines and lift stations to transport the water uphill over a substantial distance and at great expense. Both Rio Rico and the City of Nogales have utilized funds from the transfer of their CAP allocations to retire former agricultural land in order to utilize the water rights to meet future demands and will continue to do so.

2.6.2.2 Surface Water Lakes

The City of Nogales may use up to 4,200 acre-feet of surface water from Patagonia Lake, although this volume is presently reserved solely for emergency use. To retrieve this potential supply, city planners would need to design and construct a potable water delivery and treatment system. If the City were to build a delivery system connected to Patagonia Lake, they would be statutorily limited to the use of this water supply only during times of emergency.

Peña Blanca Lake has experienced water quality problems discovered with the detection of mercury in its fish population. However, mercury has not been detected in water samples taken to date. Consequently, it possible that this problem concerns sediment contamination and its impact on the local food chain. Surface water rights or claims associated with this lake are primarily owned by the United States Forest Service and the Arizona Game and Fish Department. Additional legal arrangements would need to be made for a water provider in the Santa Cruz AMA to obtain an allotment from Peña Blanca Lake, if it is physically and economically possible to deliver this water for municipal use.

2.6.2.3 Effluent

2.6.2.3.1 Indirect Uses

In 1996, 14,301 acre-feet of influent (untreated wastewater) flowed into the NIWWTP, the vast majority of which was subsequently discharged into the Santa Cruz River (IBWC, 1997). Since the construction and initial operation of the NIWWTP, the riparian area in the Santa Cruz River has expanded and additional development has occurred resulting in an increase in municipal water demand. The Department begins to address water management challenges such as maintaining sufficient water supplies to meet current and other committed demands with the adoption of consistency with management goal criteria for the Assured Water Supply Rules (AWS Rules) for the Santa Cruz AMA. The Third Management Plan helps to outline the water management concerns of the AMA by providing hydrologic information and detailing current water use trends. Because the effluent generated by the NIWWTP is owned in part by Mexico, water management strategies will need to be developed which address the interrelated nature of supplies and demands on both sides of the international border.

As more development occurs in the Amado-Tubac area, water use will increase and the need for recharge of effluent will be an important component of maintaining safe-yield conditions. The Department encourages the construction of centralized wastewater facilities, such as the Arivaca Junction Wastewater Treatment Pond, which could generate effluent to meet some the local demands, such as agricultural irrigation, and preserve the quality of the water supply in this region.

2.6.2.3.2 Direct Uses

Effluent has not been directly used in the past. The City of Nogales has indicated its intention to use effluent in the future for watering turf at Palo Duro municipal golf course. Rio Rico and Tubac represent two communities in addition to the City of Nogales that may have the potential to utilize effluent for golf course turf watering in the future.

2.6.3 Factors Affecting Renewable Supplies

Water management efforts by the Sonoran government could impact water levels in the Santa Cruz River downstream from the International Boundary. Sonora is proposing to replenish effluent in the Los Alisos basin to help supply that area, reducing demand in the Santa Cruz basin. These concepts are being explored further in the Wastewater Facilities Planning Process coordinated by the IBWC.

Water supplies could also be impacted locally if the City of Nogales or Rio Rico were to obtain and recover effluent recharge credits for their share of NIWWTP effluent discharge into the Santa Cruz River. This could change the point at which the water is replenished and recovered, which may help to manage local water table levels.

2.7 SUMMARY AND CONCLUSIONS

The dual water management goal of Santa Cruz AMA is to maintain safe-yield conditions and prevent local water table levels from experiencing long-term declines. However, local water table levels fluctuate with variations in weather patterns, water withdrawals within the Santa Cruz River basin (in Mexico and in the United States), and incidental recharge from agricultural irrigation and wastewater treatment plant discharge.

The Department is currently calibrating a hydrologic model for the region which will assist in water management planning and the development of rules and requirements that will allow for the achievement of the AMA's dual goal.

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CHAPTER

3

Water Use Characteristics

3.1 INTRODUCTION

This chapter describes current water use by each of the three water demand sectors in the Santa Cruz Active Management Area (AMA): municipal, industrial, and agricultural users. Natural system demands including riparian demand and water outflow from the AMA are also discussed. Water use patterns for each demand sector are described, including past trends in water use and anticipated growth patterns. Finally, a table of recent demands per year is presented which illustrates the volume of water needed on an AMA-wide scale to be able to meet those demands. The table shows the trend in increasing demand in certain sectors. As demands increase beyond current levels, additional supplies will need to be obtained in order to maintain safe-yield conditions. The table does not address local water table level conditions. Chapters 2 and 8 describe localized water table level conditions and methods by which water supplies may be distributed in order to meet the portion of the AMA goal that requires that long-term declines in local water table levels be prevented.

The Santa Cruz AMA includes most of Santa Cruz County and a small portion of southern Pima County. The major communities include the City of Nogales, Rio Rico, Tubac, and Amado. Based on data from the Arizona Department of Economic Security (ADES), the Arizona Department of Water Resources (Department) estimated that 34,623 persons resided within the Santa Cruz AMA in 1997. Population in the AMA is projected to increase to 58,480 persons by 2025 (ADWR and ADES, 1997). Population is concentrated along the Santa Cruz River corridor and at Nogales, Arizona. The Santa Cruz AMA also experiences a large fluctuation in temporary residents attributable to the close business and family connections between the AMA and the Mexican state of Sonora.

Numerous families, both in the Santa Cruz AMA and throughout the state, have relatives in Mexico. This accounts for much of the travel through Nogales, Arizona and Nogales, Sonora. Nogales is also a center for tourism and commerce as a port of entry for many products, including a significant volume of produce from Mexico and other central and even South American countries. These factors, along with others, combine to make Nogales, Arizona and Nogales, Sonora the largest international transit corridor in Arizona. Small commercial properties, government facilities, schools and hotels continue to grow in order to serve traffic passing through. Municipal water demands will increase as economic growth continues.

Nogales, Sonora is a center for *maquiladoras*, American owned factories in Mexico which provide economic opportunities on both sides of the border. Distribution warehouses in Nogales, Arizona ship large volumes of agricultural produce and manufactured goods from Mexico throughout the United States. Much of the growth in Rio Rico and Nogales, Arizona is attributable to these employment sectors. The impact of the North American Free Trade Agreement (NAFTA) and the stability of the Mexican currency will undoubtedly play a key role determining whether economic prosperity will continue to create new jobs in the area.

Residential growth has also been fueled by an increase in retirement communities and business commuters from the Tucson metropolitan area. Single family homes are the dominant pattern in housing. New residential subdivisions are under construction in the Tubac, Rio Rico, and Nogales areas. Several thousand residential lots in Rio Rico have been platted but are not yet developed.

Each water demand sector has unique water use characteristics that affect the trend in demand. Agricultural demand includes water used for crop irrigation by irrigation grandfathered right holders. Municipal demand includes water supplied by cities, towns, and private water companies for domestic, industrial, and commercial purposes. Municipal demand does not include water withdrawn from individually owned, small wells (wells that pump less than or equal to 35 gallons per minute). These small wells are exempt from the Department's water use reporting and water conservation requirements. Industrial demand includes water withdrawn pursuant to non-irrigation grandfathered rights or permits for industrial purposes. Figure 3-1 shows the volume of water used by each of the three water demand sectors from 1985 through 1997. Table 3-1 shows the proportion of the total AMA water use each sector comprised in 1985, 1990, and 1995.

FIGURE 3-1
WATER USE BY SECTOR
1985 - 1997
SANTA CRUZ ACTIVE MANAGEMENT AREA

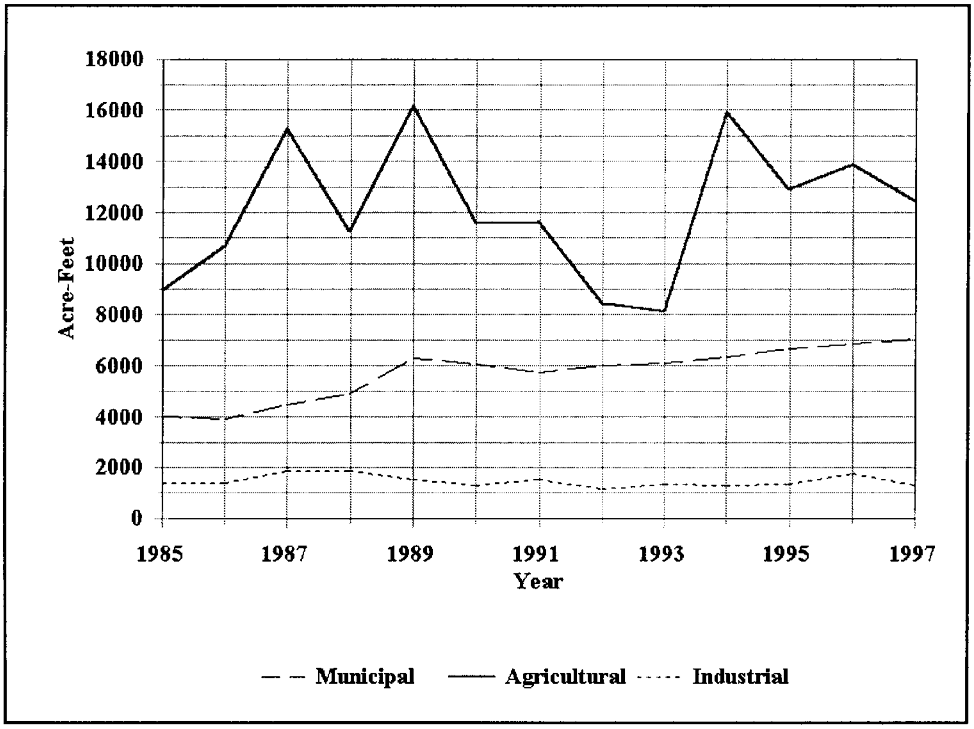


TABLE 3-1
WATER USE BY SECTOR
1985, 1990, AND 1995
SANTA CRUZ ACTIVE MANAGEMENT AREA

Sector	1985		1990		1995	
	Total Use (Acre-feet)	% of AMA	Total Use (Acre-feet)	% of AMA	Total Use (Acre-feet)	% of AMA[2]
Agricultural	8,960	62	11,603	61	12,884[1]	62
Municipal	4,027	28	6,068	32	6,674	32
Industrial	1,393	10	1,328	7	1,363	7
TOTAL	**14,380**	**100**	**18,999**	**100**	**20,921**	**100**

[1] 1995 agricultural data do not include the water usage of exempt small rights; rights <10 acres in size were deregulated in 1994.
[2] Numbers may not add up to 100 due to rounding.
NOTE: Municipal water use associated with exempt wells (wells that pump less than or equal to 35 gallons per minute) is not shown.

In this chapter, the following topics are discussed in the order listed:

- Agricultural Water Use Characteristics
- Municipal Water Use Characteristics
- Industrial Water Use Characteristics
- Average Annual Water Demands (1982-1995)
- Conclusions

3.2 AGRICULTURAL WATER USE CHARACTERISTICS

Certificates of Irrigation Grandfathered Rights (IGFRs) were issued to farmers in the early 1980s if two or more acres of land were irrigated between 1975 and 1980. In 1994, legislation removed the conservation requirements for IGFRs that were 10 acres or less in size, provided they were not part of an integrated farming operation. Certificates of IGFRs designate the number of irrigation acres allowed to be irrigated. A water duty and a maximum annual allotment for water withdrawn from wells are established by the management plan for each IGFR (see Chapter 4). With few exceptions, no new land greater than two acres in size can be irrigated within an AMA.

In addition to being issued an IGFR, many farmers within the Santa Cruz AMA also filed a claim for a surface water right since during historical times water has been diverted from the Santa Cruz River for beneficial uses. In the Santa Cruz AMA, since all water withdrawn from wells is regulated for compliance under the water conservation requirements, all water withdrawn, regardless of its source (surface water, groundwater, or effluent), must be reported to the Department and included in the compliance calculation.

The total amount of water currently allocated annually under the Second Management Plan to all IGFRs in the Santa Cruz AMA is approximately 23,000 acre-feet. If the holder of an IGFR uses less than the total annual water allotment for his acreage, the unused portion is credited in an irrigation flexibility account for that IGFR. The balance in this account is cumulative. Flexibility accounts may be debited if more than the annual water allotment is used; however, debits may only be accrued up to 50 percent of the annual water allotment. Water demand in excess of the maximum debit limit is considered a violation of the conservation requirement and may result in compliance action by the Department. The total amount of flexibility account (flex) credits accumulated by the end of 1995 for all Santa Cruz AMA IGFRs was about 114,000 acre-feet. Most IGFRs have accumulated many credits. While some farms have fewer credits, there are currently no farms in the Santa Cruz AMA in a debit situation.

The Department's analysis of the annual water use data for Santa Cruz AMA IGFRs for the years 1992 through 1997 indicates that water use for most IGFRs already has been less than the final Second Management Plan maximum annual groundwater allotment, which was calculated based upon an assigned irrigation efficiency of 85 percent for most farms. This analysis is depicted in Table 3-2.

As displayed in Table 3-2, in any given year, more than a third of the regulated IGFRs do not use any water. Of the rights that used water during the period from 1992 through 1997, between 42 and 25 percent used less than half of the Second Management Plan final allotment. Many of these rights may have been sold and fallowed their land while a sale was pending. Many right holders are planting less than the maximum allowable acres for their farm each year. Some farms no longer double crop. IGFRs continue to accrue flex account credits in years where water is not used. With the trend in agricultural land being sold to developers in the Santa Cruz AMA, it is anticipated that more and more rights will become fallow and credits will continue to accrue.

TABLE 3-2
WATER USE BY LARGE AGRICULTURAL RIGHTS
COMPARED TO SECOND MANAGEMENT PLAN FINAL ALLOTMENT
SANTA CRUZ ACTIVE MANAGEMENT AREA

Year	1992	1993	1994	1995	1996	1997
# of Rights ≥ 10 Irrigation Acres	64	65	64	65	65	65
# of Rights Using With Zero Use[1]	24	27	23	27	27	25
# of Rights Using > Zero but ≤50% of SMP Final Allotment[2]	27	22	22	19	16	16
# of Rights Using > 50% of SMP Final Allotment but ≤SMP Final Allotment	8	11	12	12	14	18
# of Rights Using > SMP Final Allotment	5	5	7	7	8	6

[1] These rights reported zero water use for the calendar year. Many of these rights are no longer farmed. Several have been conveyed to development interests. These rights will continue to accrue flex credits even in this "dormant" state.
[2] The 50% break was used to illustrate the number of farms that are not irrigating their full acreage. The 50% break has no regulatory or statutory significance.
SMP = Second Management Plan

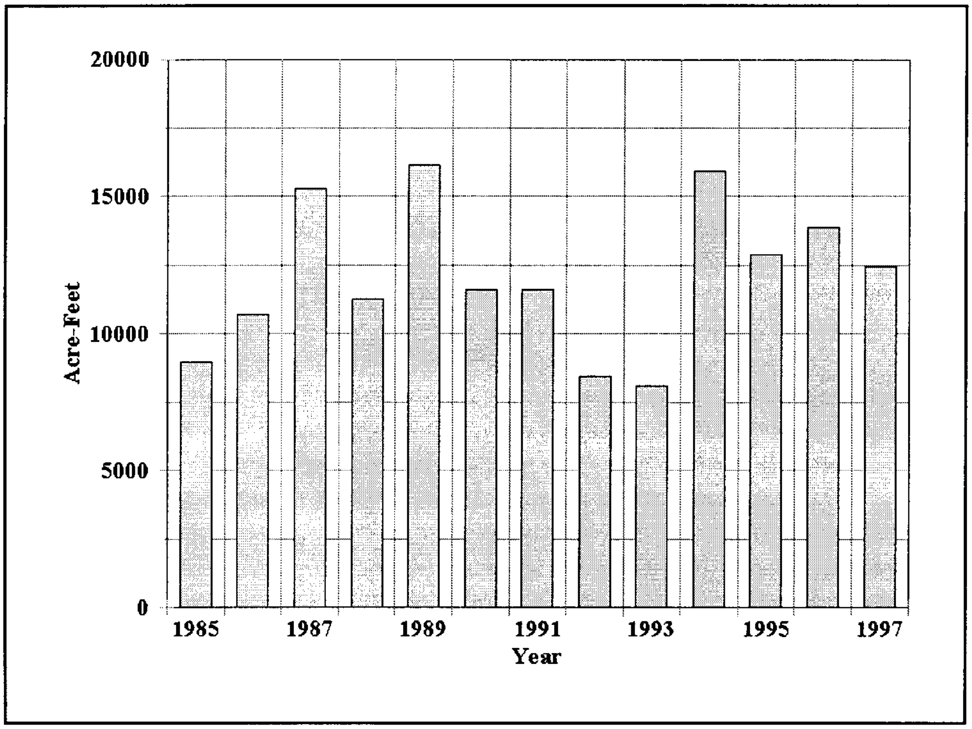
Most of the agricultural flex credits will probably not be used since they can only be used pursuant to an IGFR. Accumulated credits may be used on some IGFRs as conservation requirements become more stringent and in cases where farms irrigate full acreage or double crop. Also, under certain conditions, farmers may transfer flex credits accumulated during the preceding calendar year from one IGFR to another. This provision provides flexibility in the types of crops and amount of acreage (not to exceed the maximum number of acres allowed) that farmers may choose to irrigate and to avoid being in a flex debit or noncompliance situation.

Forage crops, such as winter wheat, alfalfa, bermuda grass, sorghum, native pasture, and fescue are the major crops grown in the Santa Cruz AMA. Other crops grown in the AMA include vegetables and grapes. The Department does not collect information from farmers on an annual basis regarding cropping patterns; however, an informal survey was conducted in 1994 during the preparation of the Third Management Plan. There were about 2,100 acres cropped in 1994, which represents less than 40 percent of maximum acreage that can be irrigated in the AMA pursuant to IGFRs. The most common method of applying water to crops in the AMA is flood irrigation systems; however, some farms are making use of sprinkler irrigation systems and drip systems.

3.2.1 Agricultural Demand

Currently, there are about 65 IGFRs regulated with water conservation requirements in the Santa Cruz AMA. Figure 3-3 shows the location of IGFR irrigable acreage in the Santa Cruz AMA. An IGFR is monitored for compliance with its conservation requirement if it is over 10 acres in size or less than 10 acres in size but part of an integrated farming operation. The irrigation acres associated with these rights total about 5,300 acres with a maximum annual groundwater allotment of more than 20,000 acre-feet. Agricultural water use currently accounts for just under two-thirds of the total annual water use in the Santa Cruz AMA. Water demand is influenced by many factors that vary annually, including weather. However, the total agricultural water use in the Santa Cruz AMA is strongly affected by the single largest IGFR, which is owned by Rio Rico Properties. Annual fluctuations in Rio Rico Properties' water use can be partly attributed to a statutory provision which states that owners of surface water rights may lose those rights if they fail or cease to use appropriated water for five successive years. A.R.S. § 45-141. Figure 3-2 graphs agricultural water use from the years 1984 to 1997. The years 1992 and 1993 were cooler and wetter than other years during the period and water use was correspondingly less.

FIGURE 3-2
HISTORIC AGRICULTURAL DEMAND (ACRE-FEET)
1985-1997
SANTA CRUZ ACTIVE MANAGEMENT AREA



Water application rates vary considerably from farm to farm in the Santa Cruz AMA. The 1994 survey collected information on cropped acres, crops grown and total water use for the twenty largest agricultural users in the Santa Cruz AMA. For these users, water was applied to the crops at an average rate of 7.4 acre-feet per acre not considering double cropping. However, this figure is strongly influenced by the application rate of Rio Rico Properties. Water use efficiencies within the Santa Cruz AMA also vary considerably from farm to farm with some farms deficit irrigating and other farms attempting to periodically demonstrate use consistent with their surface water rights claims.

3.3 MUNICIPAL WATER USE CHARACTERISTICS

The Groundwater Code (Code) defines municipal use as "all non-irrigation uses of water supplied by a city, town, private water company or irrigation district..." A.R.S. § 45-561.11. Municipal water providers serve water pursuant to service area rights and may be operated by incorporated cities and towns or by private water companies. A private water company may be a member-owned or corporately-owned entity which distributes or sells water and is regulated by the Arizona Corporation Commission. The Department also regulates the following entities as water providers if they withdraw water from one or more non-exempt wells (wells that pump over 35 gallons per minute): mobile home parks; well cooperatives; homeowners' associations; and large institutional facilities such as schools, prisons, and military installations. By definition, large municipal providers serve over 250 acre-feet of water (about 81 million gallons) per year and small municipal providers annually serve 250 acre-feet of water or less. There are 14 water providers in the Santa Cruz AMA regulated under the municipal conservation program. Water provider service areas are located on Figure 3-4.

SANTA CRUZ AMA

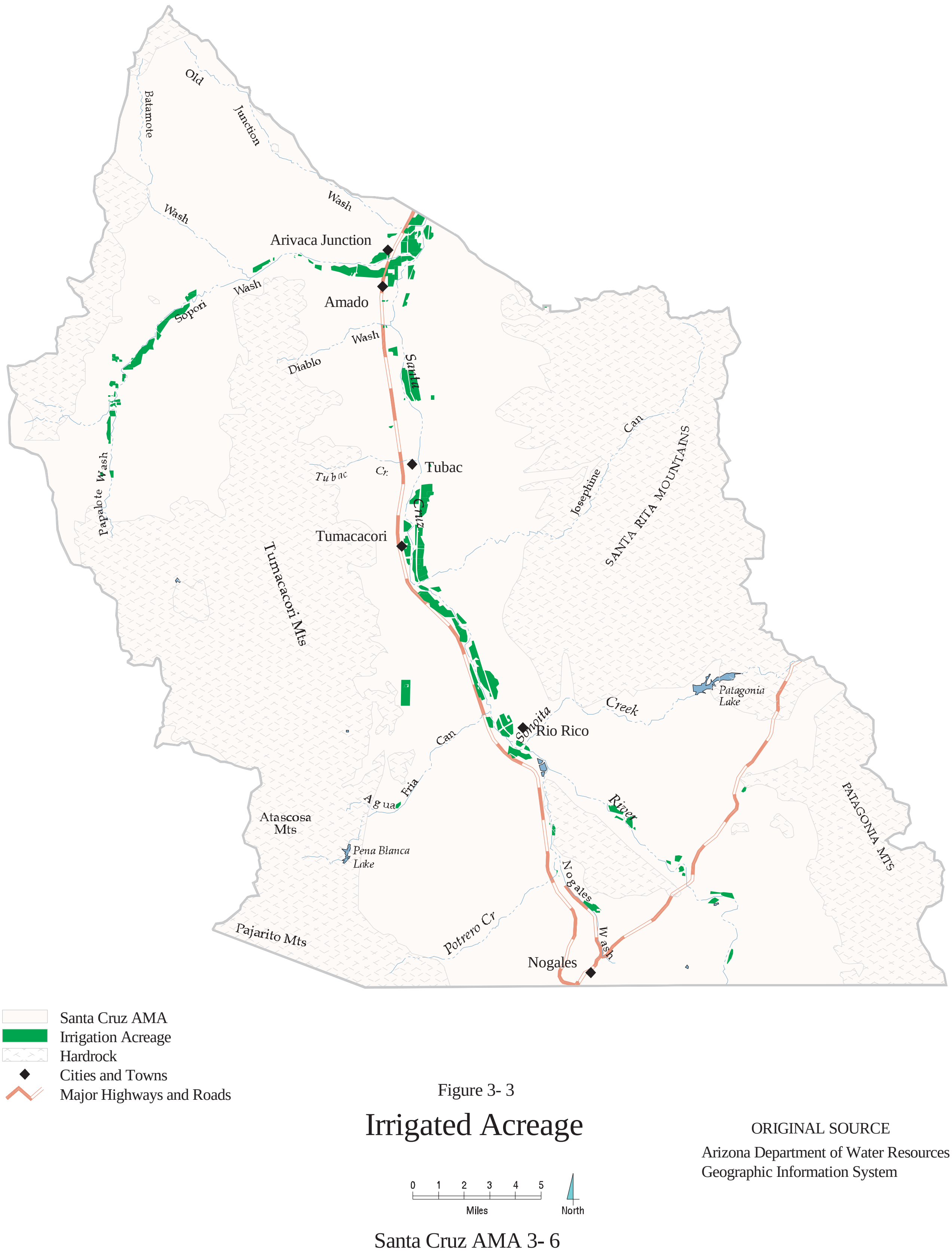


Figure 3- 3

Irrigated Acreage

ORIGINAL SOURCE

Arizona Department of Water Resources
Geographic Information System

Municipal water use is analyzed volumetrically and in terms of the average gallons per capita per day (GPCD) rate of the water users. This form of analysis allows a comparison of the relative water use per customer of each water provider to its GPCD conservation requirement and is used to assess conservation potential. The GPCD conservation requirement for water providers is an allocation tool that has the effect of quantifying the service area right based on population served. Table 3-3 shows population, water use, and GPCD rates for municipal providers in the Santa Cruz AMA for 1985, 1990 and 1995.

TABLE 3-3
MUNICIPAL PROVIDER WATER USE 1985, 1990, AND 1995
SANTA CRUZ ACTIVE MANAGEMENT AREA

Year	Population	Total Use (Acre-Feet)	Total GPCD
1985	20,247	4,027	178
1990	27,234	6,068	199
1995	31,453	6,674	189

3.3.1 Municipal Demand

Municipal water demand has increased with population growth. Municipal providers are required to meet water conservation requirements, as described in Chapter 5. Water use by the municipal sector is expected to continue to increase during the third management period, which will increase the challenge to maintain the AMA goals. The Department and the local community will have to continue to work closely to ensure that new development is consistent with the AMA goals. This will require creative water management solutions as well as some statutory and rule changes.

Table 3-4 shows historic municipal demand in the Santa Cruz AMA by the four large municipal providers and the sum of small municipal providers from 1985 through 1997. The four large providers and the small providers as a whole have steadily increased water demand since 1985. Rio Rico has grown significantly since 1985. The following section discusses water use patterns within the four large municipal provider service areas and historic water use by small municipal providers in the Santa Cruz AMA.

3.3.1.1 Large Providers

There are four large municipal providers in the Santa Cruz AMA. The City of Nogales is the only municipality in the AMA that is a large provider. The other three large providers are Rio Rico Utilities, Valle Verde Water Company, and Citizens Utilities - Tubac. Table 3-5 summarizes the 1992 - 1995 average per capita information for the four large providers.

3.3.1.1.1 City of Nogales

The largest municipal provider, the City of Nogales, is a municipality whose service area is located predominately east of Interstate 19 with a small portion situated west of the interstate. The southern boundary of the service area is the international border. The service area encompasses approximately 32 square miles and includes areas both inside and outside the city limits. Municipal uses of water in the service area consist of residential demand, produce storage and processing, use by the tourist service industry, and light manufacturing. Two turf-related facilities, Palo Duro and Kino Springs golf courses, also use water supplied by the City of Nogales.

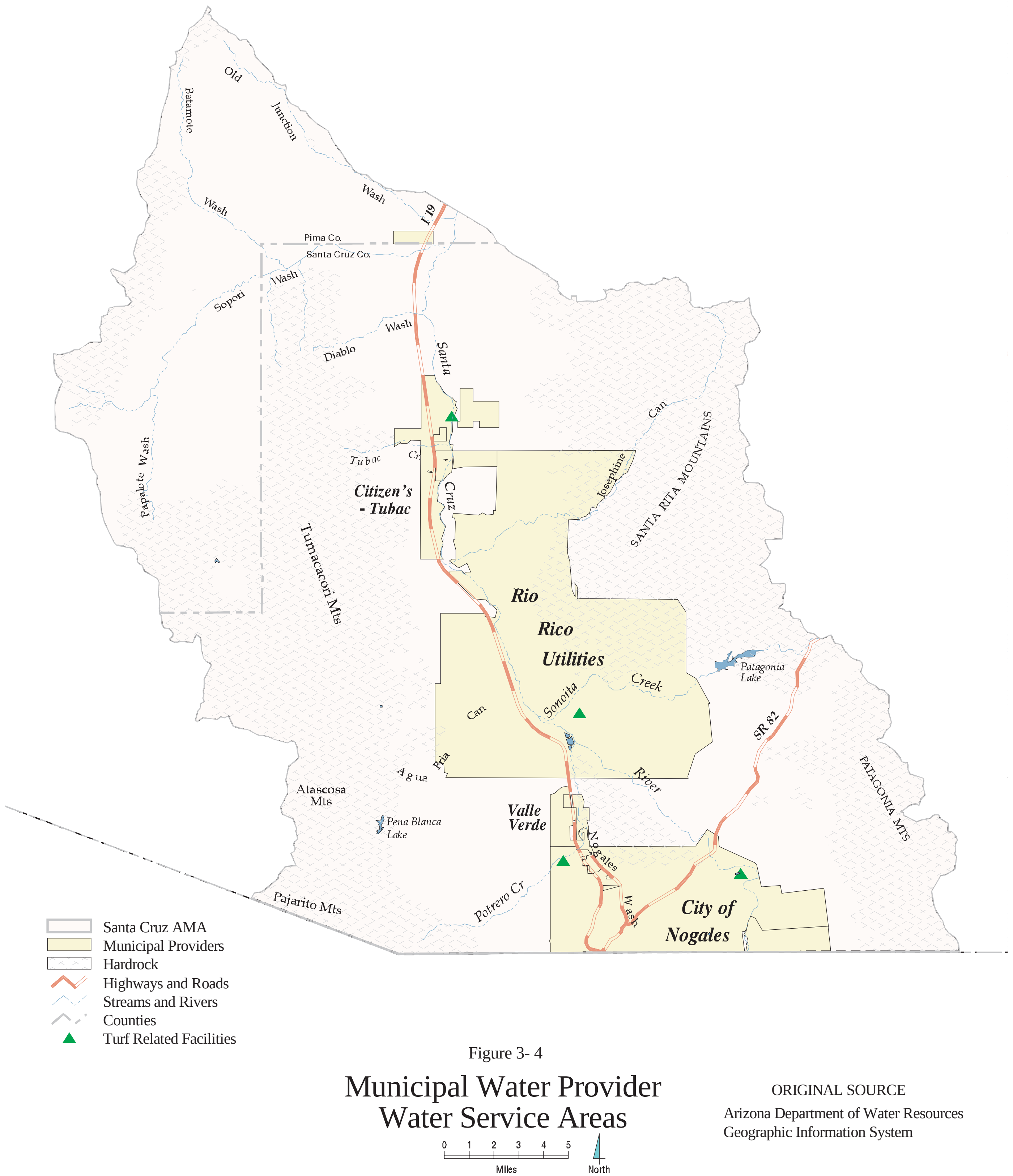


Figure 3- 4

Municipal Water Provider Water Service Areas

ORIGINAL SOURCE
Arizona Department of Water Resources
Geographic Information System

TABLE 3-4
MUNICIPAL WATER DEMAND (ACRE-FEET)
BY PROVIDER TYPE 1985 THROUGH 1997
SANTA CRUZ ACTIVE MANAGEMENT AREA

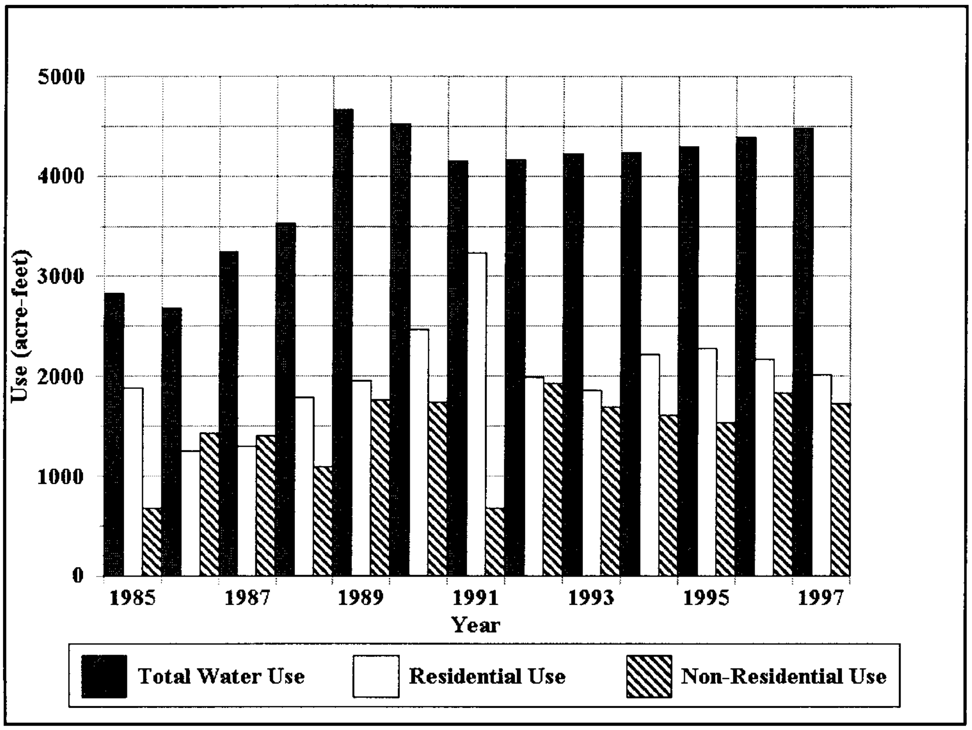
Year	City of Nogales	Rio Rico Utilities	Valle Verde Water Co.	Citizens - Tubac	Small Providers	Total Municipal Water Demand
1985	2,821	415	241	169	381	4,027
1986	2,683	421	265	223	331	3,923
1987	3,250	456	259	197	334	4,496
1988	3,532	579	290	187	330	4,918
1989	4,668	748	292	209	366	6,283
1990	4,529	678	291	212	358	6,068
1991	4,147	737	275	198	389	5,746
1992	4,169	935	288	211	403	6,006
1993	4,218	1,053	274	219	370	6,134
1994	4,239	1,155	299	246	392	6,331
1995	4,290	1,361	384	244	395	6,674
1996	4,386	1,440	347	253	421	6,847
1997	4,482	1,469	415	277	400	7,043

TABLE 3-5
1992-1995 AVERAGE SERVICE AREA CHARACTERISTICS
LARGE MUNICIPAL PROVIDERS
SANTA CRUZ ACTIVE MANAGEMENT AREA

	Nogales	Rio Rico	Valle Verde	Tubac
Total GPCD	202	172	105	246
Residential GPCD	100	111	76	173
Non-Residential GPCD	81	39	19	38
Lost %	11%	11%	10%	13%

Total water use by the City has been steadily increasing since 1985. The City supplied 4,290 acre-feet in 1995. Per capita rates within the service area have fluctuated considerably over time, which may be due to a number of factors including weather conditions, distribution system difficulties, and record-keeping changes. Non-residential per capita use peaked in 1989 when Nogales merged another smaller service area (the Yerba Buena Water Company, which included the Kino Springs golf course) into its service area. The total per capita use rate in the Nogales service area has been extremely stable over the period from 1991 through 1997.

FIGURE 3-5
HISTORIC WATER USE
CITY OF NOGALES
SANTA CRUZ ACTIVE MANAGEMENT AREA



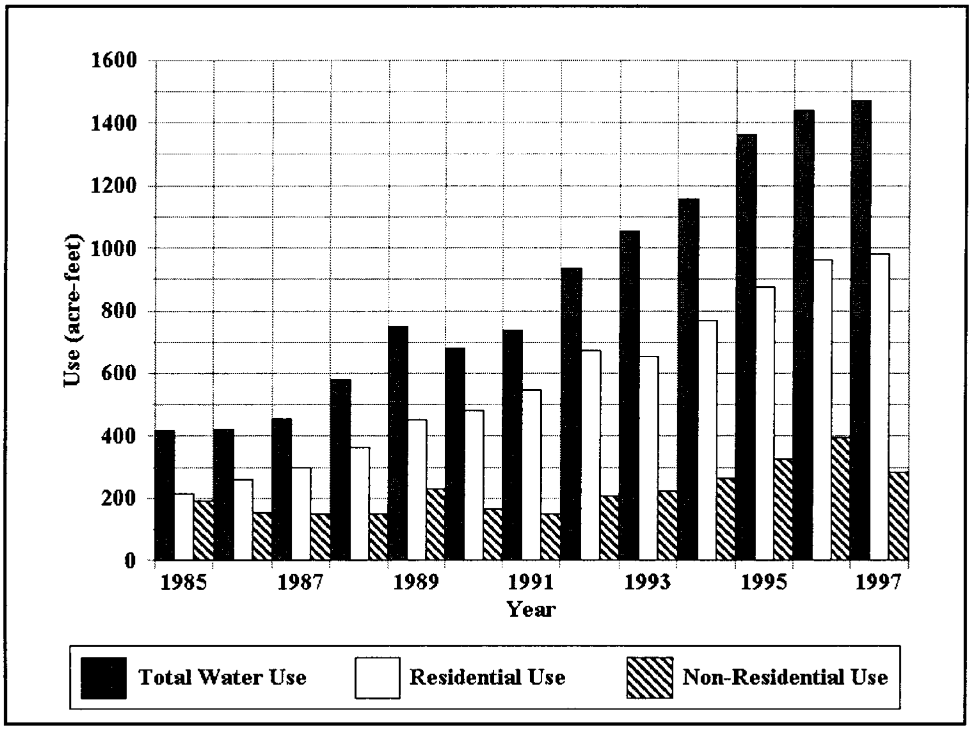
When comparing the GPCD rate of Nogales with that of other large municipal providers, both within the AMA and in other AMAs, Nogales' GPCD is significantly higher. This may be due in part to the greater proportion of non-residential water demand within the Nogales service area.

Part of this non-residential demand is due to sanitary and other water uses associated with the estimated 30,000 people who cross the international border from Nogales, Sonora into Nogales, Arizona each day. Some of these daily visitors spend the day with relatives and water use associated with this component of the daily population influx is reflected in Nogales' residential water demand. Residential water demand may also be impacted by visits from out-of-town family. Because visiting family members do not reside in Nogales, Arizona, they are not counted as service area population.

3.3.1.1.2 Rio Rico Utilities

The Rio Rico Utilities service area is situated in the central portion of the AMA, primarily on the east side of Interstate 19, with a small portion located to the west of the interstate. The service area comprises nearly 79 square miles. Water use in the Rio Rico service area has increased from 415 acre-feet in 1985 to 1,361 acre-feet in 1995. The non-residential per capita use rate has decreased in the service area as residential development has filled in around the golf course. The residential per capita rate fluctuates with weather conditions, but shows a reduction between 1989 and 1994.

FIGURE 3-6
HISTORIC WATER USE
RIO RICO UTILITIES
SANTA CRUZ ACTIVE MANAGEMENT AREA



There were 6,737 people served through Rio Rico Utilities in 1995. The daily use rate in 1995 was 180 GPCD. The 1992 through 1995 average GPCD rate for the Rio Rico Utilities service area was 172 GPCD. Water use consists of residential domestic demand and tourist service industry needs. The Rio Rico service area, unlike Nogales, is located downstream of the Nogales International Wastewater Treatment Plant (NIWWTP). While the potential for growth in the Rio Rico service area is much greater than that of Nogales, Rio Rico may benefit from a more continuous water availability due to its location downstream from the NIWWTP, as long as effluent continues to be discharged at historic rates.

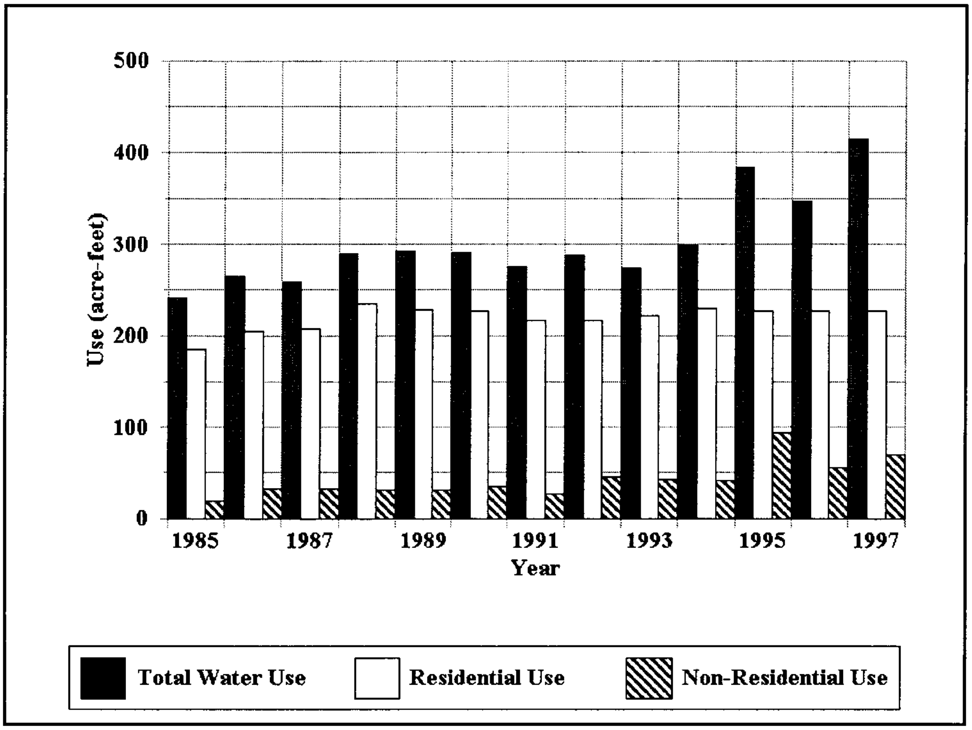
3.3.1.1.3 Valle Verde Water Company

The Valle Verde Water Company service area lies along Interstate 19 and Nogales Wash. It encompasses approximately two square miles and provided water supplies to 2,734 people in 1995. The daily water use rate was 125 GPCD in 1995 with 384 acre-feet of water delivered. The 1992 through 1995 average GPCD rate was 105 GPCD. Municipal water uses include residential domestic demand, two schools, and tourist service industry needs. Valle Verde is a small service area that can be significantly impacted by the addition of a large user. For many years, the population of the service area was nearly static, but recent growth and the addition of the new schools to the water service area have resulted in an increase in the overall service area GPCD rate.

3.3.1.1.4 Citizens Utilities - Tubac

Citizens Utilities - Tubac service area is north of Rio Rico, roughly between Chavez Siding Road and Santa Gertrudis Lane, paralleling Interstate 19. The service area is fairly small, the provider having just

FIGURE 3-7
HISTORIC WATER USE
VALLE VERDE WATER COMPANY
SANTA CRUZ ACTIVE MANAGEMENT AREA



begun using over 250 acre-feet per year in 1996. Water use by Citizens - Tubac was 244 acre-feet in 1995.

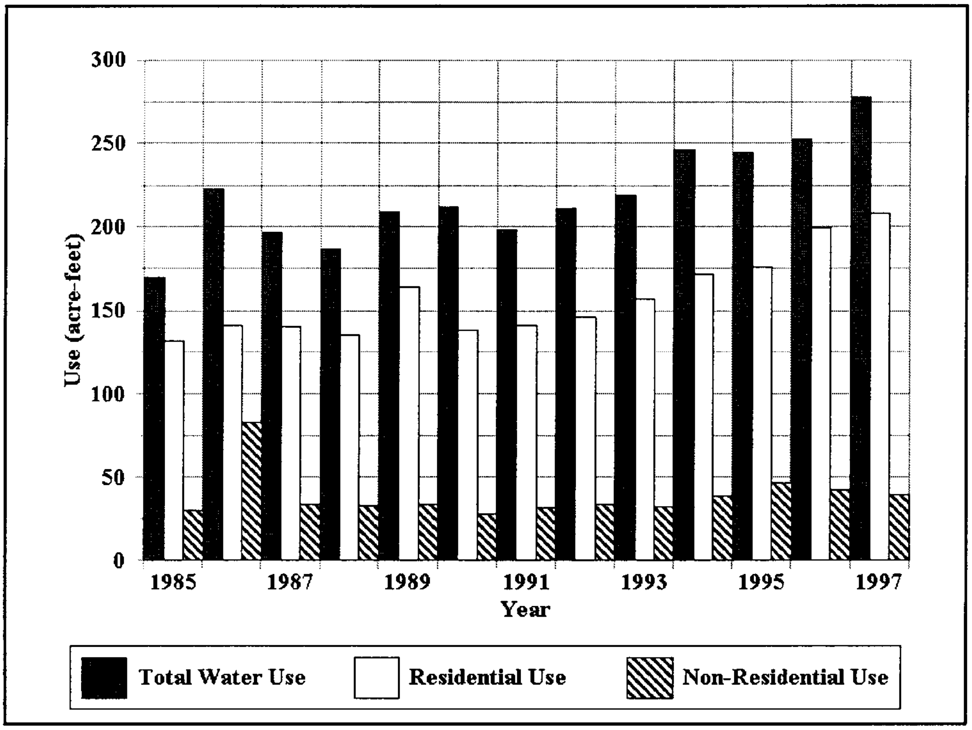
The 1995 GPCD rate for this provider was 254 GPCD. The 1992 to 1995 average GPCD rate in the service area was close to this at 253 GPCD. Uses are mostly for residential purposes; typically single family homes. The GPCD rate for Citizens - Tubac is higher than the other large providers primarily due to the low number of persons per household and the lush landscapes common in some subdivisions, and several properties are large with small pastures for horses and other livestock. Citizens - Tubac serves some small commercial establishments, including some art galleries, restaurants, shops, and studios; however, the water use associated with commercial uses is not great.

3.3.1.2 Small Municipal Providers

There are currently 10 active small municipal providers in the Santa Cruz AMA. Figure 3-9 shows the average GPCD rate and volume of water used by small municipal providers between 1985 and 1997. The 1985 - 1995 average GPCD rate for small providers in the Santa Cruz AMA was 172 GPCD, however, based on the available data, the average annual GPCD rate for small providers fluctuates over time. This may be due to the impact of rainfall on exterior water use by small provider customers. In addition, the data collected from small providers are generally not as accurate as the information collected from large providers in the AMA.

In 1994, a legislative change to the large provider definition resulted in two of the large providers being reclassified as small providers; Citizens Utilities - Tubac and Lakewood Water Company. Citizens - Tubac reattained large municipal provider status in 1996 and will be regulated as a large provider in the third management period.

FIGURE 3-8
HISTORIC WATER USE
CITIZENS UTILITIES - TUBAC
SANTA CRUZ ACTIVE MANAGEMENT AREA



Lakewood Water Company will not be regulated as a large provider until the annual water pumped, diverted, or received in a calendar year is 250 acre-feet or more. Table 3-6 provides recent information on Lakewood Water Company.

The 10 small providers are divided into the following categories: three mobile home or RV parks, two private water companies regulated by the Arizona Corporation Commission, and five miscellaneous providers. Miscellaneous small providers include well cooperatives, ranch housing, or small housing complexes which operate exempt wells. While the majority of small provider water deliveries are made to residential customers, per capita usage is highly variable due to differences in water costs, household income, and lifestyle.

Population for small municipal providers was estimated using the average occupancy rate and persons per household figures from the 1990 U.S. Census for the Nogales County Control Division, except for Lakewood Water Company which is located in Pima County. In order to calculate the population served each year, the number of housing units served by small providers, as reported on the Annual Water Withdrawal and Use Reports, were tallied and then multiplied by the county average occupancy rate and persons per occupied housing unit.

FIGURE 3-9
HISTORIC WATER USE
SMALL MUNICIPAL PROVIDERS
SANTA CRUZ ACTIVE MANAGEMENT AREA

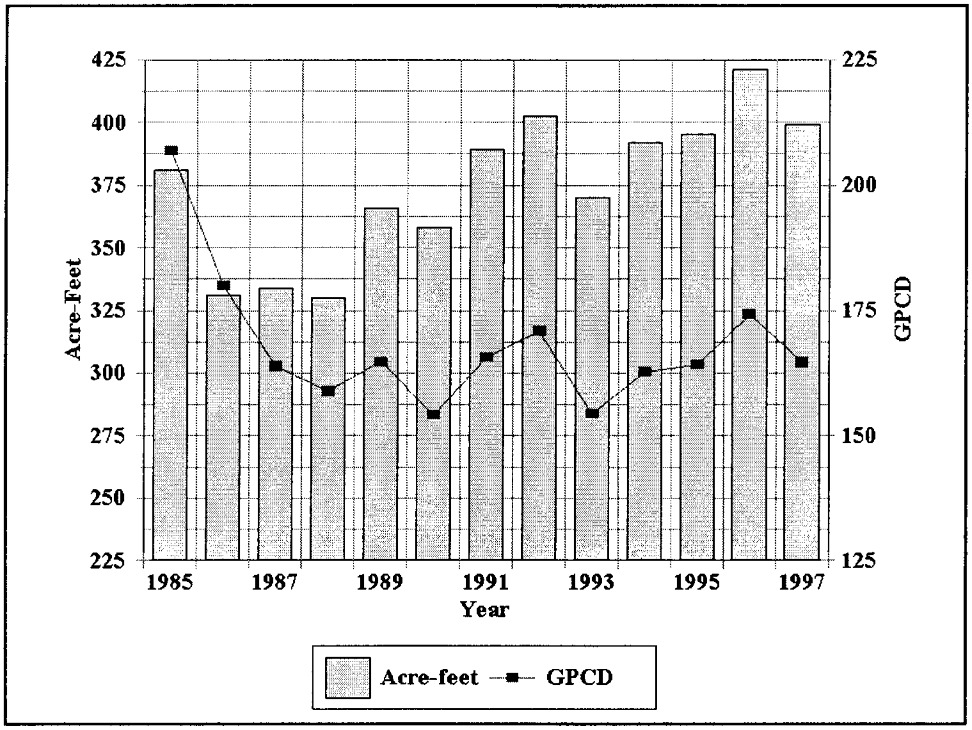


TABLE 3-6
LAKEWOOD WATER COMPANY WATER USE CHARACTERISTICS
1992 - 1997
SANTA CRUZ ACTIVE MANAGEMENT AREA

		1992	1993	1994	1995	1996	1997	92-95 Ave
Lakewood Water Co.	GPCD	133	139	147	153	153	150	143
	Use	134	136	145	150	150	148	141
	Pop.	900	874	877	877	877	877	882

3.3.2 Municipal Water Supply

Historically, municipal providers in the Santa Cruz AMA have relied primarily on wells within the Younger Alluvium of the Santa Cruz River to provide a potable water source for residents and industries. Recently, the City of Nogales has begun to consider alternative sources of supply to its two municipal wellfields, one in Potrero Canyon (Potrero Creek) and the other near Highway 82 in the Santa Cruz River.

If Nogales is successful in its search for alternative supply sources and in the implementation of additional water management techniques, the municipal water supply for the Nogales customers should be more secure during times of drought. All municipal providers are encouraged to explore the option of the direct use of effluent for such purposes as golf course irrigation. If main supply wells continue to pump from the Younger Alluvium of the Santa Cruz River, this aquifer may be susceptible to long-term water level declines as demand increases as well as during periods of prolonged drought conditions.

Direct reuse of effluent has not occurred to a significant degree in the Santa Cruz AMA. However, effluent discharge from the NIWWTP is a major source of supply contributing to the maintenance of water levels in the Younger Alluvium downstream of the plant. It is unclear whether this discharge will continue to be available in the future. However, as development increases, the construction of small, local wastewater treatment plants to serve individual subdivisions could create new sources of effluent supply in new locations, which can be reused. The installation of septic systems may not result in replenishment of the aquifer and may not provide for reuse of the water resource.

3.3.3 Municipal Sector Issues

Growth in the municipal sector is influenced by the economies both of the United States and Mexico. Increases in the daily traffic across the international border increases non-residential water demand in the City of Nogales water service area. As more jobs are created in southern Arizona, demand will continue for new home construction. Individuals looking to retire will continue to move to southern Arizona for its many amenities. As population and water demand increase, achievement of the AMA goals will become increasingly challenging. Water withdrawn from small private (exempt) wells is not required to be reported to the Department and is not subject to water conservation requirements. High concentrations of exempt wells may have an impact on local water table levels in some areas. Additional analysis of the potential impacts of exempt wells requires further study.

3.3.3.1 Non-Resident Water Uses

The issue of international traffic associated with family visiting across the border is primarily an issue for the City of Nogales. The City's residential GPCD rate may be inflated because visiting family members who do not reside in the service area cannot be counted as service area population. This could result in overestimation of the conservation potential for existing residential users in the City's service area. In order to make an adjustment to the existing residential conservation potential, additional information must be obtained that allows quantification of this possible effect. The City would have to apply for an administrative review of its conservation requirements pursuant to A.R.S. § 45-575(A) before the Department could make an adjustment to the existing residential conservation potential.

3.3.3.2 Exempt Well Use

Wells with pump capacities less than or equal to 35 gallons per minute (gpm) are exempt from most of the provisions of the Code. With few exceptions, withdrawals from such wells may not exceed 10 acre-feet per year. Many exempt wells withdraw water from within the Younger Alluvium. The locations of exempt wells often overlap areas of municipal demand. The result of this concentration of demand could potentially restrict water availability to all users during periods of drought.

Many exempt wells are located near the Santa Cruz River and other tributaries and away from hardrock areas. Although new development is occurring on the Older Alluvium and new exempt wells are being drilled there, especially near Tubac. Water withdrawals associated with a cluster of several exempt wells, especially if it occurs in the microbasin area of the AMA, could potentially impact local water table levels. As assured water supply consistency with management goal criteria are drafted, adopted, and implemented for the Santa Cruz AMA, the number of applications to drill exempt wells could increase due to an increase in the number of dry-lot subdivisions (subdivisions that are not served from a central water distribution system). Although existing exempt wells are widespread and are considered to have little impact on water tables or water supplies, the Department may need to begin to focus additional attention on analysis of the impacts of dry-lot subdivisions on the AMA goals, particularly in regards to the protection of local water table levels portion of the goal. A preliminary effort to gage the volume of exempt well demand has been prepared by the Department and is discussed in Chapter 5.

3.3.3.3 Water Use in Nogales, Sonora

The two communities of Nogales, Arizona and Nogales, Sonora share water resources, a wastewater collection and treatment system, and an international line which economically divides the communities as much as it unifies them. Nogales, Sonora has an official population estimate of 205,000 but unofficial estimates are considerably higher. Nogales, Sonora has undergone extremely rapid growth during recent years due to the establishment of foreign-owned factories called *maquiladoras*. The factories are located in Mexico to capitalize on the ability to manufacture products inexpensively. Increased migration to border communities such as Nogales is linked to an increase in employment opportunities and the prospect of an improved standard of living.

The *maquila* industry has led to an explosive rate of growth in several Mexican border communities. Since the economic development of the Mexican communities is unable to keep pace with the population growth, infrastructure improvements lag behind. It has been estimated that less than half of the population in Nogales, Sonora has 24 hour per day water service. A sizeable minority of the population does not have any direct access to potable water within their homes. The State of Sonora currently does not measure pumpage at their wells but best available estimates indicate that the residential per capita rate is about 40 GPCD (IBWC, 1997). Not all the water transmitted through the distribution system is delivered to the water customers due to a fairly high percentage of system losses.

Nogales, Sonora has developed a water supply plan in response to the current water shortage. Further detail on this plan is described in Chapter 8.

3.4 INDUSTRIAL WATER USE CHARACTERISTICS

Industrial water users pump water from their own wells pursuant to a Type 1 or Type 2 non-irrigation grandfathered right or a groundwater withdrawal permit. These rights and permits have annual volumetric allotments. Industrial users are subject to annual conservation requirements described in Chapter 6. All industrial users have general conservation requirements. In addition, the following industrial user groups in the Santa Cruz AMA have specific conservation requirements:

- Turf-Related Facilities (≥ 10 acres)
- Sand and Gravel Facilities (>100 acre-feet/year)
- New Large Landscape Users (>10,000 square feet)
- New Large Industrial Users (>100 acre-feet/year)

3.4.1 Industrial Water Demand

In the Santa Cruz AMA, industrial water demand fluctuates depending mostly on weather conditions. While industrial water use is limited by the total volume of grandfathered rights and permits, some new permits can be issued to support industrial uses. Industrial use has been relatively constant since 1985, although peaks in use have occurred periodically, generally during years of unusually hot and dry weather.

3.4.1.1 Historic and Current Demand

Beginning in 1987, the reporting requirements of the First Management Plan went into effect and the data reported by industries to the Department improved. As a proportion of overall AMA demand, industrial use has remained fairly constant over time as shown in Figure 3-10.

FIGURE 3-10
HISTORIC WATER USE
INDUSTRIAL SECTOR
SANTA CRUZ ACTIVE MANAGEMENT AREA

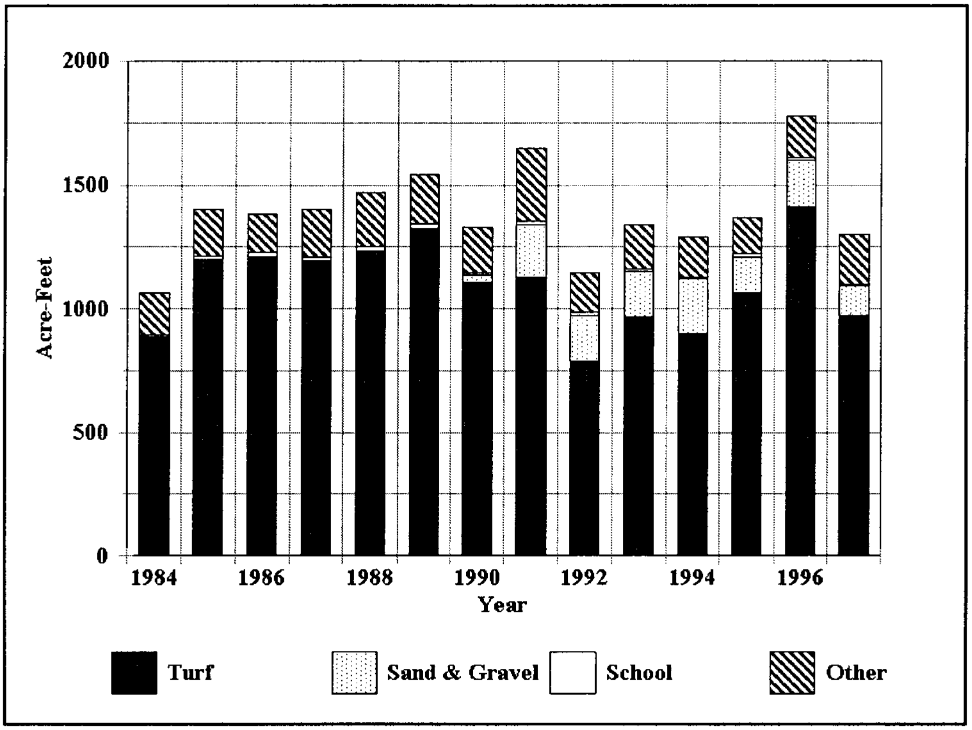


Table 3-7 contains detailed water use information for 1995, including the number of industrial facilities by category, associated water rights and permits, and the volume used in 1995. Industrial users currently use considerably less water than they are entitled to use pursuant to their grandfathered water right and permit allotments. The actual allotment associated with the industrial sector is 9,248 acre-feet per year not including hydrologic testing permits. The difference between the allotment volume and actual use is partially explained by the process used to establish grandfathered water rights. Type 2 non-irrigation grandfathered right allotments for industrial users were based on the highest volume of water withdrawn from 1975 to 1980. Some industrial users have ceased operations entirely, although they have retained their water rights. Industrial uses accounted for about 1,363 acre-feet of water in 1995, representing 7 percent of total AMA water use (Table 3-1).

3.4.1.2 Water Demand by Industrial Subsector

3.4.1.2.1 Turf-Related Facilities

Turf-related facilities constitute the largest industrial user category in the Santa Cruz AMA and include two golf courses. Two additional courses, Palo Duro and Kino Springs, are served by the City of Nogales and are considered individual users. See Chapter 5 for more detail on individual users. The two industrial facilities, Rio Rico and Tubac Ranch Properties, withdraw water pursuant to Type 2 non-irrigation rights. In 1995, 1,063 acre-feet of water was used by the Rio Rico and Tubac courses for watering turf grass and other landscaping, and for filling lakes and ponds.

There are several schools in the Santa Cruz AMA; however, none of these are regulated as turf-related facilities because the total turfed area at each school is less than 10 acres.

TABLE 3-7
INDUSTRIAL WATER RIGHTS AND WITHDRAWAL SUMMARY - 1995
SANTA CRUZ ACTIVE MANAGEMENT AREA

User Category	Type of Right or Permit	Number of Facilities	Right & Permit Allotments (Acre-Feet)	1995 Use (Acre-Feet)
Sand & Gravel	Mineral Extraction - ZZ Cattle Corp.	1	276	141
Sand & Gravel	Mineral Extraction - Abe's Materials	1	75	0.53
Sand & Gravel	Mineral Extraction - Multi-Metals Inc.	1	23	1
School	Type 2 - Nogales Unified School District #1	1	17	4.38
School	General Industrial Use Permit - Sahuarita Unified School	1	12	10.2
Turf	Type 2 - Rio Rico Properties, Inc.	1	860	585.64
Turf	Type 2 - Tubac Ranch Properties	1	706	477
Various	Type 1 (total number of rights)	11	5,962.66	1
Various	Type 2 (other than Turf and schools)	35	826.1	139.82
Various	Other Permits	2	490	4.06
TOTAL			**9,248**	**1,365**

3.4.1.2.2 Sand and Gravel Facilities

Although there is more than one sand and gravel operation using water in the Santa Cruz AMA, only one operation is large enough to be regulated as an industrial sand and gravel operation. The ZZ Cattle Corporation used 141 acre-feet in 1995 and is steadily increasing its production of rock products. This facility currently withdraws water pursuant to a mineral extraction permit issued by the Department. Permits are generally issued for a 10-year period and must be renewed through an application process.

3.4.1.2.3 Other Subsectors

The remainder of industrial water use in the Santa Cruz AMA is not specifically categorized. However, other industrial users include produce packaging industries, commercial businesses and light industries, recreation, stock water, schools, and parks. During the third management period, the Santa Cruz AMA will review other industrial uses to determine if additional subsector programs are needed. In 1995, the remaining industrial users reported 161 acre-feet of water withdrawn.

3.4.2 <u>Industrial Water Supplies</u>

As of 1997, all industrial users in the Santa Cruz AMA use water withdrawn from wells to meet their water needs.

3.4.3 General Issues in the Industrial Sector

Major issues that the industrial sector will be facing during the third management period include the potential for additional golf courses to be built that utilize water withdrawn from wells and the impact of any increased demand on the AMA's safe-yield and local water table level maintenance goals. Unused allotments associated with industrial rights represent a significant potential demand. Type 2 grandfathered rights can be moved from one parcel of land to another where new wells can be drilled. This could impact the AMA's ability to manage local water tables.

Rights and permits held by industrial users fluctuate from year to year as permits expire and rights are conveyed or retired. Currently, the total volume of water allotted to industrial rights and permits is about 9,000 acre-feet. While some of the unused allotment may never actually be put to use, it is not possible to predict future utilization.

3.5 RIPARIAN AREA DEMAND

Riparian area demand is currently the largest demand in the Santa Cruz AMA. This demand is made up of the water consumed by dense vegetative tracts along the Santa Cruz River's effluent-dominated perennial reaches. Estimates of riparian area water demand have been calculated previously (USBR, 1952; Harshbarger, 1970; ADWR, 1989; Coggeshall, 1990; ADWR, 1996; and MacNish, 1997). Revised estimates of riparian acreage and evapotranspiration in the Santa Cruz AMA for 1954 and 1995 are being developed by the Department using new data retrieved from digitized aerial photographs covering the area. Preliminary results indicate an increase in riparian acreage from about 6,200 acres in 1954 to about 8,600 acres in 1995. Calculation of vegetation type/density acreage and associated consumptive use was accomplished by digitizing information interpreted from aerial photos for both years. The preliminary estimate of the total annual riparian evapotranspiration was about 17,500 acre-feet in 1954, and about 25,800 acre-feet in 1995. Most of the increase in riparian acreage and associated evapotranspiration occurred along the Santa Cruz River downstream from the NIWWTP. Effluent discharge from this site has had a substantial role in the development of a perennial stream reach which supports the riparian habitat. Other factors may include shifts in long-term climatic patterns or agricultural activity.

Riparian areas expand and thrive where the water table is maintained. Effluent being discharged into the Santa Cruz River has so far stabilized water table levels in a portion of the Younger Alluvium. However, as human water demands increase and the availability of effluent remains uncertain, the riparian habitat may become threatened. Conversely, if effluent generation increases through an expanded population and improved wastewater collection system, greater volumes of effluent discharge could actually stimulate riparian growth and riparian area demand.

3.6 WATER DEMAND COMPONENTS

This section provides a description of the water demand components which are included in the water resource analysis contained in Chapter 11 of this plan. This information will assist in developing an understanding of the fluctuating supply characteristics of the Santa Cruz AMA and the impact of this condition on the AMA's water management goals. The information contained in this plan will be updated as new data becomes available. Supply components are contained in Chapter 2 of this plan.

Table 3-8 below contains water demand information for each water use sector for recent years. Hydrologic and natural demand factors are listed as a range where such information is available. Other values are 1992-1995 averages. The natural demand components of this table were prepared in 1997 by the Department's Hydrology Division. This information will be updated as the Department's hydrologic model for the Santa Cruz AMA is completed and additional data is collected from the field.

TABLE 3-8
ANNUAL WATER DEMANDS
SANTA CRUZ ACTIVE MANAGEMENT AREA
(Figures Rounded to Nearest 100 Acre-Feet)

Component	Time Period	Average or Range in Acre-Feet
Municipal Demand	1992-1995	6,300
Agricultural Demand	1992-1995	11,300
Industrial	1992-1995	1,300
Riparian Demand	estimated	25,800
Underflow Leaving the AMA	estimated	6,800 - 10,600
TOTAL OUTFLOWS		**51,500 - 55,300**

3.6.1 Groundwater Underflow Leaving the Santa Cruz AMA

Estimates of underflow leaving the Santa Cruz AMA at the northern boundary range from 6,800 acre-feet per year for the Younger Alluvium aquifer only (ADWR, 1997) to 10,600 acre-feet per year for the combined Younger and Older Alluvial aquifers (Travers and Mock, 1984).

3.6.2 Riparian Evapotranspiration

Significant ET losses occur along the riparian corridor of the Santa Cruz River. Other riparian areas include Nogales Wash, Sonoita Creek, and Sopori Wash. Estimates of riparian acreage, as previously noted in this chapter, were made from an analysis of 1995 aerial photography. Riparian acreage was divided into two major classes: mesquite, and cottonwood/willow. These major classes were further subdivided into low, medium, and high density classifications. Estimated effective precipitation was subtracted from the consumptive use values for various densities of mesquite and cottonwood/willow. The resulting values were multiplied by their respective acreages to estimate maximum riparian evapotranspiration.

An evapotranspiration reduction factor was estimated by first subtracting the University of Arizona's estimate of total riparian evapotranspiration from the NIWWTP to Santa Gertrudis Lane (3,300 acre-feet/year) from the Department's maximum estimate for the same river segment (4,100 acre-feet/year). It was assumed that the difference between the two estimates (800 acre-feet) was solely due to the amount of evapotranspiration supplied by precipitation rather than water in storage. This assumption seemed reasonable because the University of Arizona estimate was already reduced to account for precipitation on the riparian area. A reduction factor of .58 acre-feet per riparian acre was calculated by dividing the difference (800 acre-feet) by the total riparian acreage in that river segment (1,380 acres).

3.6.3 Water Withdrawals

Agricultural, industrial, and municipal pumpage was derived from annual water use reports submitted to the Department by all regulated water users in the Santa Cruz AMA. The average annual water use for each sector was developed from 1992-1995 annual use data. This data is compiled in the Registry of Groundwater Rights (ROGR) database. Pumpage associated with exempt wells was not included in this water resource analysis since annual use is not reported to the Department.

3.7 SUMMARY AND CONCLUSIONS

Increases in water demand in the Santa Cruz AMA are primarily associated with the municipal water use sector. Although agricultural water demand fluctuates from year to year, new irrigated land cannot be brought into production within an AMA. Industrial demand has been fairly stable for many years, although there is a significant volume of unused industrial water rights in the Santa Cruz AMA.

Natural system demands include riparian area consumption and water that flows out of the AMA as subflow (beneath the land surface). These figures have been estimated and the range in estimates is included for outflow. Riparian demand is currently the largest demand category in the Santa Cruz AMA.

Chapter 2 highlighted the variability in seasonal and annual surface flow on the Santa Cruz River. Because natural system supplies vary, increases in demand will need to prepare for drought periods and find ways to store available supplies during years where supplies are abundant. Chapter 11 examines a range in conditions that might exist in the future by comparing demand projections under current and increased efficiency scenarios and minimum and maximum natural recharge.

SECTION

II

Regulatory Programs

Preface

Section I provided an overview of the Arizona Department of Water Resources' (Department) statutory authority and management objectives and described the physical, climatic, demographic, and water use characteristics of the Active Management Area (AMA). The fluctuating natural supply conditions (both seasonally and annually), uncertainty regarding the future availability of effluent to recharge the Younger Alluvium of the Santa Cruz River, the uneven distribution of AMA water supplies, and continued municipal growth, as well as the desire of AMA residents to both maintain safe-yield conditions and local water levels, particularly along the Santa Cruz River, provide compelling justification for the development of progressive and responsible water management programs.

This section of the Third Management Plan is entitled "Regulatory Programs" because the programs described are required of certain entities who withdraw, distribute, or receive water from a well or are preconditions to obtaining certain permits or financial assistance. The regulatory chapters that follow describe specific requirements for water users within the AMA. Programs contained in this section include mandatory conservation requirements, 2 additional programs designed to encourage the direct use of effluent, recharge program eligibility and operational criteria, criteria for obtaining financial assistance for water management programs, and plan implementation activities, including the Department's compliance and enforcement program and additional well spacing criteria unique to the Santa Cruz AMA for consistency with the AMA goals.

Chapters 4, 5, and 6 contain the agricultural, municipal, and industrial conservation programs, respectively. Chapter 7 discusses the Department's groundwater quality management program and provides an assessment of water quality within the AMA. Chapter 8 describes the Department's augmentation and recharge program, and Chapter 9 discusses the Department's water management assistance program. Finally, Chapter 10 outlines the Department's policies and procedures for implementation of the Plan, including well spacing criteria. Chapter 10 also contains an evaluation of the impact of the Plan on the Tucson AMA.

The regulatory programs are based on a philosophy developed by the Department over the course of the last two management periods throughout all AMAs. In the first management period, the Department focused on the conservation of groundwater as its primary management goal. In the second management period, the Department continued to enhance the conservation programs but also implemented a program for the augmentation of water supplies, which included incentives for the increased use of renewable supplies. In the third management period, the Department's focus is on both water conservation and augmentation of water supplies. The Department's regulatory philosophy is based on its overall water management goals for the management plans: the conservation of water through the efficient use of all water sources and the augmentation of water supplies to ensure a long-term, secure supply.

The water management goals of the Santa Cruz AMA are to maintain safe-yield conditions and to prevent local water tables from experiencing long-term declines. The AMA water management goals and the overall mission statement of the Department are guiding concepts in the agency's activities.

Understanding of the basic framework of the regulatory programs requires knowledge of the components of the safe-yield and local water table goals and the Department's compliance approach. The framework is described below.

- **The AMA Management Goal of Maintaining Safe-yield**

The Santa Cruz AMA must maintain safe-yield conditions. "Safe-yield" is defined by statute to mean:

> [A] groundwater management goal which attempts to achieve and thereafter maintain a long-term balance between the annual amount of groundwater withdrawn in an active management area and the annual amount of natural and artificial recharge in the active management area. A.R.S. § 45-561 (12).

The statute specifies that safe-yield is "a long-term balance." Thus, the hydrologic conditions in the AMA cannot simply be viewed in the short-term but rather must be viewed over a longer period of time. Further, establishing a "balance" for the Santa Cruz AMA is more complicated than comparing the total amount of groundwater withdrawals for the AMA to the amount of recharge occurring in the area in a given year. For the Santa Cruz AMA the Department recognizes the extensive interactions between surface water and groundwater. Although much of the water in storage in the Younger Alluvium of the Santa Cruz River may be legally classified as surface water, all subflow is accounted for as part of the water in storage for purposes of determining whether the AMA is at safe-yield.

In analyzing whether an AMA is at a safe-yield condition, the Department considers the following factors which impact water levels and water in storage:

1. <u>Net natural recharge</u>: Net natural recharge in a given year is the volume of water that naturally recharges the water supply minus the natural depletions to the water supply over the course of that year. The components of net natural recharge that increase the water supply are stream channel infiltration, mountain front recharge, and water inflow into the AMA. The components that naturally deplete the water supply are water outflow out of the AMA and water loss due to evapotranspiration. Infiltration of treated effluent discharged to surface water channels is not a component of net natural recharge.

2. <u>Incidental recharge</u>: Incidental recharge originates as water or surface water which percolates down to the water table during and after its use for human activity. In the Santa Cruz AMA, the volume of incidental recharge is largely dependent on the quantity of municipal effluent discharged into stream channels, and the volume and efficiency of agricultural and mining water use. It should be noted that incidental recharge that occurs during the use of the water may not be permitted as an underground storage activity under the state's Underground Water Storage (UWS) Program. Water that is treated after its use for municipal purposes, becomes effluent, and is released into a natural streambed, however, is specifically recognized by the UWS Program as eligible to become a managed underground storage activity. *See A.R.S. §§ 45-801.01 et seq.* As is more fully explained below, storage credits that are accrued through an effluent discharge that has been permitted as a managed storage facility cannot be counted as a contribution to safe-yield.

3. <u>Artificial recharge</u>: Under the state's UWS Program, A.R.S. §§ 45-801.01 *et seq.*, persons may undertake recharge projects to purposely add water to an aquifer without the right to withdraw it in the future. However, artificial recharge is commonly used as a storage mechanism to accrue credits with the expectation of future recovery. Stored water for which credits have been issued cannot be counted as a contribution to safe-yield, because it is already allocated to the water storer. Therefore, this type of water has no impact on the safe-yield volume; however, it does result in a temporary increase in water in storage.

Not all water stored under the UWS Program can be recovered. The volume of recharge which is allocated permanently to the aquifer, or the "cut to the aquifer" that results from generation of certain types of recharge credits does benefit the aquifer and is a component of the safe-yield water supply. In addition, any non-recoverable storage that is conducted under the UWS Program in a given year can be included in the safe-yield volume for that year. Recharge credits that are generated and then subsequently extinguished prior to use are also a component of the safe-yield supply.

4. Water withdrawn from wells: Annual pumpage volumes from the AMA's aquifers are considered in the safe-yield calculation. Withdrawals associated with irrigation grandfathered rights, non-irrigation grandfathered rights, groundwater withdrawal permits, and municipal providers are calculated as debits to the aquifer system. Water withdrawn from wells pursuant to surface water rights would also be a debit from the aquifer system.

5. Committed demand: Committed demand is an important component in the calculation of safe-yield. In the context of an application for a Designation of Assured Water Supply, the applicant must demonstrate the physical availability and management goal consistency of a water supply for a 100-year period which includes sufficient water to serve current, committed, and projected demand. Committed demand is associated with platted, undeveloped lots which will be served in the future. In the assured water supply demonstration process, all demands, including the committed demand, must be determined to be physically available and consistent with the management goal of the AMA. This demand is reflected in the safe-yield calculation. Outside of the designation process, committed demand is associated with unbuilt subdivisions for which a Certificate of Assured Water Supply already exists. In addition, lots that otherwise fall outside of the Assured Water Supply Program requirements represent a potential future demand. This committed water demand must be counted as already having been "allocated" when examining safe-yield. To do otherwise would allow water to be allocated multiple times to multiple developments, resulting in an underestimation of the long-term demands on the AMA's aquifers.

The volume of water that can be withdrawn while maintaining a safe-yield condition in the AMA is not a fixed amount; it will change due to annual variations in incidental, net natural and artificial recharge, as well as other factors listed above. The AMA is in a state of safe-yield as long as the sum of the recharge, not including water that could be recovered as storage credits, exceeds or equals current withdrawals of water from wells and committed demands in the AMA.

Because water level changes are direct indicators of changes in water storage, they are the measured data which support the other factors of the safe-yield analysis. Changes in water levels occur seasonally and annually in the Santa Cruz AMA and are expected to continue fluctuating to some degree though safe-yield is maintained in the long-term. However, average water levels should not experience broad-ranging, significant, and continuing declines after adjustments are made for the factors just described. Therefore, water levels are considered in evaluating whether the AMA is maintaining its safe-yield goal.

- **The AMA Management Goal of Preventing Long-term Declines in Local Water Table Levels**

In addition to maintaining safe-yield based on overall conditions within the AMA, the Santa Cruz AMA has the additional goal of preventing long-term declines in local water table levels. Local water table levels fluctuate seasonally in the Younger Alluvium of the Santa Cruz River. Because most of the water demand in the AMA is concentrated within the Younger Alluvium, new wells and replacement wells in new locations within this alluvial material or in the Older Alluvium which intercept mountain front recharge to the Younger Alluvium, may result in water table level declines in the absence of regulation. While water table declines may also occur from new or replacement wells located in other areas of the AMA, the Department will initially concentrate its efforts to maintain local water table levels within the Younger Alluvium.

The statutes require that the management plans for the Santa Cruz AMA contain additional well spacing criteria for new and replacement wells in the AMA consistent with the AMA management goals of maintaining safe-yield and preventing local water table declines in the long-term. These criteria, contained in Chapter 10 of this plan, may be further refined as additional information is collected and analyzed. If new information indicates that additional regulation of new and replacement wells is necessary to maintain the AMA goals, the additional well spacing criteria contained in this plan will be modified.

- **Total Water Use Conservation Requirements and "Stacking"**

Water withdrawn from wells is generally the most accessible and inexpensive source of supply in the Santa Cruz AMA. Nearly all water users in the AMA obtain water from wells. With water demand so heavily concentrated within the Younger Alluvium of the Santa Cruz River, accounting for all water withdrawn from wells when determining compliance with conservation requirements helps to ensure that water stored in the Younger Alluvium, which is susceptible to drought and is limited in its capacity, is used efficiently.

Water users may also utilize a source other than water withdrawn from wells to meet their needs, such as direct use effluent and poor quality remediation water that under special conditions is not accounted for as water withdrawn from a well. The Department attempts to provide incentives that will promote use of these alternative supplies whenever and wherever possible. Effluent is an important source of supply in the Santa Cruz AMA, whether used directly, allowed to percolate to the water table through an underground storage facility, or abandoned by the owner into the natural channel of a stream for use as surface water or for natural recharge. Use of poor quality water, as well as effluent, whether used directly or indirectly, must be beneficial and not wasted in an AMA where few alternative water supplies are readily available.

For these reasons, the Department believes that it is both impractical and unwise to consider water withdrawn from wells as the only measure of regulatory compliance. Moreover, with the limited water storage available in the Younger Alluvial aquifer, separating water withdrawn from wells into its legal components would be not only contentious and legally complicated but could allow inefficient use of a common supply. To ensure that water users make reasonable use of all sources, and to encourage efficiency and flexibility in the use of alternative supplies, the regulatory strategy includes evaluation of the total water use of each water user and provider, and setting conservation requirements based upon that total water use. In keeping with the Department's statutory obligations and limitations, however, the conservation requirements of the management plan apply only to water withdrawn from wells, other than stored water recovered pursuant to a recovery well permit.

The Department's regulatory program is, therefore, structured around the concept of "stacking" different types of water, by type, in a compliance hierarchy, with water withdrawn from wells on top. If a total water use conservation requirement is exceeded by a user of water from wells, the amount of the violation of that requirement will be measured by the amount of water (other than stored water) withdrawn from wells that was used in excess of the regulatory requirements. This strategy will ensure that water is being used as wisely and efficiently as economically possible.

- **Flexibility in the Components of the Regulatory Plan**

  The Department recognizes that water use varies by year and locality. Therefore, the Department has provided maximum flexibility when administering the regulatory provisions of the management plan. For example, most regulatory provisions include a basic program, with one or more alternative programs designed to meet special circumstances. The basic program is generally designed to place simple numerical limits on water use, leaving the means of achieving those limits wholly up to the water user or provider. The alternative programs tend to remove numerical limits in favor of specific conservation measures more suitable to the water user.

  Another component of regulatory flexibility is the establishment of "flexibility accounts" for most allotment-based requirements. These accounts generally allow water users to borrow or bank water from one year to the next in order to overcome the variation in use caused by weather or other unforseen circumstances. Flexibility accounts are mandated by statute for agricultural users, and the Department has used this example to incorporate flexibility accounting into municipal and industrial programs as well.

- **Administrative Review and Variance of Conservation Requirements**

  Even with the general flexibility of the regulatory programs, the Groundwater Code (Code) recognizes that certain individual conservation requirements may pose hardship in certain circumstances. To allow relief in these situations, the Code provides for an administrative review and variance process. The emphasis in this process is on the impact of a particular conservation requirement as it is applied to an individual water user. Administrative review and variance are fact-intensive inquiries which may result in some regulatory relief and are considered on a case-by-case basis.

- **Accounting for Water Use**

  In order to determine compliance with conservation requirements, the Department must adopt a set of policies for commingled systems. Volumetric accounting does not subdivide water withdrawn from wells into separate components. Volumetric accounting policies would apply where different sources of water (i.e., effluent, diverted surface water, groundwater) are blended and distributed to water users in the same water distribution system. A system using multiple sources of water is considered a commingled system. Because conservation requirements apply to all water withdrawn from a well, other than stored water, the Department does not distinguish between surface water and groundwater withdrawn from wells when determining compliance with conservation requirements in the Santa Cruz AMA. The Department is continuing to develop policies for "volumetric" accounting.

  Generally, a water provider delivering different types of water through a commingled system cannot determine which type of water a customer actually received. Therefore, the provider is generally asked to account for all deliveries to its customers on a volumetric as opposed to molecular basis. This allows the provider to compute the percentage of each type of water delivered in a given year, and apply that same percentage to the water delivered to each customer, regardless of the type of water actually received by the customer. This volumetric accounting policy provides simplicity and certainty. Individual circumstances may warrant individual consideration, however, and the Department is constantly reviewing its policies on volumetric accounting to recognize necessary exceptions. Generally speaking, however, the Department does not recognize accounting which shows a concentration of deliveries of certain types of water to certain users if the delivery system is physically commingled.

- **Enforcement**

  An effective conservation plan requires effective enforcement. The Department is given wide ranging enforcement authority in the statutes to ensure that all water users are contributing their share to the overall goal of water conservation and augmentation of water supplies. While the statutes allow the imposition of substantial monetary penalties for violating either water use limitations or conservation requirements, the Department is also given considerable discretion in how that enforcement program will be managed. Overall, the Department's philosophy has been that the ability to correct management deficiencies and save water is more important than collecting monetary penalties. Therefore, most of the Department's regulatory efforts to date have involved voluntary "consent orders" where the water user in violation agrees to adopt conservation measures, guarantee future compliance, or otherwise mitigate the impact of the violation on the state's water resources in exchange for waiver or reduction of the civil penalties. This approach has worked well in the past, and has been particularly useful in making the transition from a state where water use was essentially unregulated to a state where water regulation has become a fact of everyday life.

  In the third management period, the Department will continue its policy of reviewing each suspected violation on an individual basis. The Department will also continue its policy of working with any water user in violation of the water laws to make certain that all the surrounding circumstances are understood and to explore alternative means by which the problem might be solved. In some cases, however, violations are not matters of inadvertence or misunderstanding, but are repeat offenses or voluntary decisions based on economic considerations, lack of planning, or careless disregard for the resource. During the third management period, the Department will strive to identify these latter types of violations and pursue stringent civil penalties. By so doing, the Department intends to bring greater equity and fairness to the common goal of saving our water supply. Alternative mechanisms to achieve compliance while encouraging achievement of local water management goals will also be explored.

The foregoing synopsis of the Department's regulatory approach is intended to assist the reader in understanding the reasons behind the mandatory conservation requirements in the following regulatory chapters. In addition, we have included a Plan Implementation chapter which gives more definitive explanation to many of the administrative policies and procedures introduced here. Finally, it has always been the Department's policy to offer assistance to anyone seeking to better understand or comply with the conservation requirements imposed by the management plans, or the requirements of the Code. The AMA offices or the central office in Phoenix can provide valuable support on most water management issues.

CHAPTER

4

Agricultural Conservation Program

4.1 INTRODUCTION

The Agricultural Conservation Program for the Third Management Plan contributes to the maintenance of safe-yield conditions in the Santa Cruz Active Management Area (AMA) by encouraging improved on-farm water management practices. Improved practices allow a farmer to use less water, which in turn leaves more water in the aquifer. Improved practices also help to maintain water quality.

As the Department's water management strategy for the Santa Cruz AMA continues to develop during the third management period, agriculture may play an increasingly important role in maintaining safe-yield and preventing long term declines in local water table levels. The potential exists for a new program to be developed that would compensate farmers for fallowing their fields during temporary periods of short supply so that the security of the municipal water supply can be maintained. Any such program would require additional legislative authority. Chapter 12 further discusses water management options that may be considered during the third management period.

As discussed in Chapter 3, agriculture is responsible for just under two-thirds of the total annual water use in the Santa Cruz AMA. In 1995, approximately 13,000 acre-feet of water were used for agricultural irrigation purposes. Most of this water was withdrawn from wells. Other sources of water used for agricultural irrigation include treated effluent and direct diversion of surface water flow in the Sopori Wash area of the AMA.

Under the Groundwater Code (Code), only land associated with a Certificate of Irrigation Grandfathered Right (IGFR) can be legally irrigated with water withdrawn from a well, other than stored water, within the Santa Cruz AMA. A.R.S. § 45-465. These certificates were issued by the Arizona Department of Water Resources (Department) based on crops and acreage planted from the years 1975 to 1980. Land not irrigated during this time period may not be irrigated with any water unless one of the exceptions stated in the Code applies. A.R.S. § 45-452. For each IGFR, the Department establishes a maximum annual water allotment based on certain statutory criteria.

At this time, the Department is deferring adoption of a Base Program under A.R.S. § 45-566(A)(1) as part of the Agricultural Conservation Program. This delay is based on concerns which have been raised by the agricultural community regarding the proposed adoption of an agricultural conservation program that includes water duties based upon an 85 percent irrigation efficiency.

Presently, the Department is adopting the Historic Cropping Program that was authorized by A.R.S. § 45-566.02 and conservation requirements for irrigation distribution systems. Participation in the Historic Cropping Program is voluntary and those who do not participate will be subject to the agricultural conservation requirements established by the Second Management Plan until the Department adopts a Base Program for the Third Management Plan. Descriptions of the Historic Cropping Program and the irrigation distribution system conservation program are detailed in this chapter.

In addition to these regulatory conservation programs, the Department will continue to encourage the efficient use of water by the agricultural sector through other water resource management methods.

In this chapter, the following topics are discussed in the order listed:

- Statutory Provisions
- Irrigation Water Duties and Maximum Annual Water Allotments
- Agricultural Conservation Program Components

- Non-regulatory Water Resource Management Strategies
- Future Directions
- Agricultural Conservation Requirements and Monitoring and Reporting Requirements

4.2 STATUTORY PROVISIONS

The Code limits uses of water withdrawn from wells, other than stored water, for irrigation purposes in the Santa Cruz AMA in several ways. These statutory provisions are described below.

4.2.1 Third Management Plan

A.R.S. § 45-566 requires the director to follow established guidelines in developing the management plan for the third management period (the years 2000 to 2010). For the agricultural sector, in the plan for the Santa Cruz AMA, the director:

- Shall establish an irrigation water duty for each farm unit to be reached by the end of the third management period.
- May establish one or more intermediate water duties to be reached at specified intervals during the third management period.
- Shall calculate the irrigation water duty or intermediate water duties as the quantity of water reasonably required to irrigate the crops historically grown in the farm unit and shall assume the maximum conservation consistent with prudent long-term farm management practices within areas of similar farming conditions, considering the time to amortize conservation investments and financing costs.
- After computing the irrigation water duties or intermediate water duties, may adjust the highest 25 percent of the water duties within an area of similar farming conditions by reducing each water duty in an amount up to 10 percent, except that in making the adjustment, no water duty may be reduced to an amount less than the highest water duty within the lowest 75 percent of the water duties computed within an area of similar farming conditions.
- Shall grant an exemption from the irrigation water duties at any time during the third management period if an applicant can demonstrate to the director's satisfaction that the applicant's farm unit meets specific hydrologic conditions regarding waterlogging or basin outflow.
- Shall establish additional economically reasonable conservation requirements for the distribution of water by cities, towns, private water companies, and irrigation districts within their service areas.

4.2.2 New Irrigated Lands Prohibited

Under A.R.S. § 45-452, only acres of land which were legally irrigated at any time from January 1, 1975 through January 1, 1980, which are capable of being irrigated, and which have not been retired from irrigation or conveyed for a non-irrigation use, may be irrigated with any water unless one of the following exceptions apply:

- Surface water may be used pursuant to decreed or appropriative rights established before June 12, 1980. A.R.S. § 45-452(A).

- Existing acreage irrigated with surface water may be replaced with new acreage if the surface water right is severed and transferred to the new acreage. A.R.S. § 45-172.

- State universities may irrigate new acreage not to exceed a total of 320 acres of land with not more than five acre-feet of groundwater per acre per year. A.R.S. § 45-452(I).

- Correctional facilities under the jurisdiction of the Arizona Department of Corrections may irrigate new acreage not to exceed a total of 10 acres of land with not more than four and one-half acre-feet of water per acre per year for the purpose of producing plants for consumption by inmates as part of a prisoner work program. A.R.S. § 45-452(J).

- Existing acreage damaged by floodwaters may be replaced with new acreage. A.R.S. § 45-465.01.

- Existing acreage which has a condition that limits irrigation efficiency may be replaced with new acreage. A.R.S. § 45-465.02.

4.2.3 <u>Maximum Annual Groundwater Allotments</u>

Under A.R.S. § 45-465, the maximum annual groundwater allotment for each IGFR is determined by multiplying the irrigation water duty by the water duty acres. The irrigation water duty is the annual amount of water in acre-feet per acre that is reasonable to apply to irrigated land to produce the crops historically grown (1975 to 1980) divided by an assigned irrigation efficiency. Water duty acres are the highest number of acres in a farm, taking land rotation into account, that were legally irrigated during any one year from 1975 to 1980. The maximum annual groundwater allotment may be used to irrigate any or all of the irrigation acres in the farm unit. Irrigation acres are the acres in the farm which were legally irrigated at any time from 1975 to 1980.

4.2.4 <u>Flexibility Account Provisions</u>

In order to provide farmers with sufficient flexibility to address varying climatic conditions and to take advantage of changing agricultural market conditions, the Code requires the director to establish a flexibility (flex) account for each farm which receives a maximum annual groundwater allotment. A.R.S. § 45-467. In 1987, the Department began implementing these provisions in the Tucson AMA, which included the Santa Cruz AMA at that time. Despite the use of the term "groundwater" in the statute, any IGFR holder in the Santa Cruz AMA who uses water withdrawn from a well, other than stored water, regardless of the source is regulated for compliance with the maximum annual allotment. A.R.S. § 45-466(B).

Under the flex account statute, a right holder may accumulate both flex account credits and debits. If a right holder uses water during a year in excess of the farm's maximum annual groundwater allotment, the flex account is debited. A negative balance which exceeds 50 percent of the annual allotment results in a violation of the conservation requirement. If a right holder uses less water during a year than the farm's maximum annual groundwater allotment, the flex account is credited. Accrued flex account credits are not limited, can be used at any time in future years, and may be used to offset a debit. In addition, under certain conditions right holders may transfer the flex account credits accumulated during the preceding calendar year from one IGFR to another. A.R.S. § 45-467(O).

4.2.5 <u>Historic Cropping Program</u>

In 1998, the legislature adopted A.R.S. § 45-566.02 that directs the Department to include in the Third Management Plan an agricultural conservation program entitled the Historic Cropping Program. Laws 1998, Ch. 274, § 1. Under this program, the director must calculate the maximum annual groundwater allotment as provided in A.R.S. § 45-465, and must calculate the irrigation water duty using an irrigation efficiency of 75 percent. In areas deemed by the director to have limiting soils, the statute authorizes the director to use an irrigation efficiency as low as 70 percent. In addition, the director may not register credits to the flex account established under A.R.S. § 45-467 which cause the credit balance to exceed 75 percent of the maximum annual groundwater allotment established under the Historic Cropping Program. This program is described in more detail in section 4.4.1.

4.2.6 Small Irrigation Grandfathered Rights

In 1994, legislation was passed that deregulated small IGFRs. A small IGFR is defined as an irrigation grandfathered right appurtenant to a farm with 10 or fewer irrigation acres and that is not part of an integrated farming operation of more than 10 acres. Under A.R.S. §§ 45-563.02 and 632(D), small IGFRs are not required to report annual water use or to comply with water duty limitations. Small IGFRs make up just over one-fifth of the IGFRs in the Santa Cruz AMA. Based on reporting data submitted to the Department prior to 1994, agricultural water use on these small rights accounted for less than two percent of the total annual irrigation water use.

4.3 IRRIGATION WATER DUTIES AND MAXIMUM ANNUAL GROUNDWATER ALLOTMENTS

The irrigation water duty is the primary component of the Historic Cropping Program and is used to determine the maximum annual groundwater allotment for each IGFR. The following sections describe how the Department determines water duties and maximum annual groundwater allotments.

4.3.1 Calculation of Irrigation Water Duties

The irrigation water duty is the quantity of water reasonably required per acre to annually irrigate the crops historically grown in a farm unit from 1975 to 1980. The crops historically grown in each farm unit were verified and established during the first management period. The Department calculates the irrigation water duty for each IGFR using the following formula:

$$\textit{Irrigation Water Duty} = \frac{\textit{Total Irrigation Requirement Per Acre}}{\textit{Assigned Irrigation Efficiency}}$$

In this formula, the irrigation water duty is calculated by dividing the total water requirements to produce the crops historically grown by an assigned irrigation efficiency. Each component of the formula is discussed below.

4.3.1.1 Assigned Irrigation Efficiencies

Irrigation efficiency is a measure of the overall effectiveness of water application during a crop season. The effectiveness is a function of many variables including evaporation loss, soil intake rate, water application rates, irrigation system type, crop type, and irrigation water management practices.

The assigned irrigation efficiency establishes a benchmark value which is determined for each management period in accordance with statutory provisions. For the Historic Cropping Program, the assigned irrigation efficiency for farms with non-limiting soils is 75 percent as prescribed by A.R.S. § 45-566.02.

4.3.1.2 Total Irrigation Requirement

The total irrigation requirement for each farm unit equals the amount of water needed annually to satisfy the sum of the irrigation requirements for all of the crops historically grown. For each crop, the irrigation requirement (IR) consists of the amount of water needed to meet: the consumptive use (CU) requirement of the crop, plus any other needs (ON) that the crop may have, plus any needed leaching allowance (LA), less the amount of any effective precipitation (EP). The total irrigation requirement is calculated by the following equation:

$$IR = CU + ON + LA - EP$$

The components of the total irrigation requirement equation are discussed below.

4.3.1.2.1 Consumptive Use

The consumptive use requirement of a crop is the amount of water used in transpiration and building of plant tissue, together with the amount of water evaporated from adjacent soil during the growing season. Crop consumptive use values are based on accepted scientific methods and commonly used values for the Santa Cruz AMA. Appendix 4 lists the consumptive use requirement for each crop historically grown in the Santa Cruz AMA during the years 1975 to 1980 based upon data currently available.

4.3.1.2.2 Other Needs

Water required by certain crops for purposes other than consumptive use is referred to as "other needs" water. Some vegetable crops, such as lettuce, need additional water for germination, cooling, and quality control. The Department makes adjustments for those crops which have "other needs." Appendix 4 lists the "other needs" requirements for crops historically grown in the Santa Cruz AMA.

4.3.1.2.3 Leaching Allowance

In some situations, a crop may require additional water for leaching or deep percolation. A leaching allowance may be necessary to prevent salts from accumulating in the crop root zone when high levels of total dissolved solids (TDS) are present in the irrigation water. If the accumulated salts in the soil profile are not leached below the root zone, soil salinity will increase and eventually inhibit plant growth and yields.

The procedure used to calculate the leaching allowance for a crop is shown by the following equation:

$$LA = \frac{AE}{0.85}\left[CU\left[\frac{1}{1 - \dfrac{EC_w}{5EC_e - EC_w}} - 1\right]\right]$$

In this equation, LA = leaching allowance for the crop; AE = assigned irrigation efficiency for the farm unit; CU = consumptive use requirement of the crop; EC_w = electrical conductivity of the irrigation water (expressed in millimhos per centimeter); and EC_e = tolerance of the crop to soil salinity as indicated by the electrical conductivity of the soil saturation extract (expressed in millimhos per centimeter).

Most irrigation water in the Santa Cruz AMA is of adequate quality for irrigation purposes. Consequently, the Department did not include any leaching allowances in the calculation of irrigation requirements for crops grown in the Santa Cruz AMA. If, however, a particular irrigation water supply has an EC_w value greater than 1.5 millimhos per centimeter (a concentration of approximately 1,000 milligrams per liter of TDS), the right holder may apply to the Department for an administrative review as discussed in Chapter 10.

4.3.1.2.4 Effective Precipitation

Effective precipitation is defined as the amount of precipitation occurring before and during the growing season that is available for plant growth. Because precipitation is minimal and varies considerably by year and location in the Santa Cruz AMA, effective precipitation is difficult to quantify and is not subtracted from the total irrigation requirements for the crops historically grown. However, managing the use of precipitation to offset use of other water supplies could be an important irrigation water management tool.

4.3.2 Calculation of Maximum Annual Groundwater Allotments

The maximum annual groundwater allotment for each IGFR is determined by multiplying the irrigation water duty by the water duty acres. These calculations are governed by A.R.S. § 45-465 (see section 4.2.3).

4.4 AGRICULTURAL CONSERVATION PROGRAM COMPONENTS

The following section describes the Agricultural Conservation Program for the Third Management Plan that is being adopted at this time. This program consists of two main parts: the Historic Cropping Program and the Irrigation Distribution Systems Conservation Program. Each of these programs is described below.

4.4.1 Historic Cropping Program

The Historic Cropping Program was developed by the Department pursuant to A.R.S. § 45-566.02. As required by this statute, for the Historic Cropping Program, the Department will calculate the water duty and maximum annual groundwater allotment by dividing the total irrigation requirement per acre by an assigned irrigation efficiency of 75 percent. In areas determined by the director to have limiting soils, the director may use an assigned irrigation efficiency as low as 70 percent for the water duty calculation. As further required by A.R.S. § 45-566.02, the use of flex account provisions will be limited.

In order to qualify for the Historic Cropping Program, the IGFR owner must satisfy the following requirements: (1) file an application with the Department, (2) reduce any debit balance in the existing flex account to an amount which does not exceed 25 percent of the Base Program's maximum annual groundwater allotment, (3) reduce any flex account credits in the existing flex account balance to an amount which does not exceed 75 percent of the existing maximum annual groundwater allotment, and (4) provide documentation showing that an actual irrigation efficiency of 75 percent has been or will be achieved on the farm on a seasonal basis. Once an IGFR owner has been accepted into the Historic Cropping Program, the right holder must remain in the Historic Cropping Program during the entire third management period, unless there is a change in IGFR ownership.

Participants in the Historic Cropping Program will be subject to limitations on their ability to accumulate flex account credits and debits. Right holders will only be allowed to accrue flex account credits up to 75 percent, and flex account debits up to 25 percent, of their maximum annual groundwater allotment calculated for the Historic Cropping Program. Any IGFR owner, or any person entitled to use groundwater pursuant to that IGFR who uses groundwater in an amount which causes the farm's flex account to be in arrears in excess of 25 percent of the maximum annual groundwater allotment, will be considered in violation of the conservation requirements. In addition, participants in the Historic Cropping Program will not be allowed to sell or purchase flex account credits.

In addition to these flex account credit provisions, participants will also be required to comply with certain reporting requirements. Participants must provide information regarding irrigation water management practices, irrigation system type, and the acreage and type of crops grown to assist the Department in determining program effectiveness.

The Historic Cropping Program requires a high level of farm management. Specific entrance and performance criteria must be satisfied, and only owners of IGFRs may apply (see section 4.7). IGFR owners interested in participating in the Historic Cropping Program may file an application beginning January 1, 2000 on forms provided by the Department.

4.4.2 Irrigation Distribution Systems Conservation Program

For the third management period, the director is required to establish "additional economically reasonable conservation requirements for the distribution of groundwater by cities, towns, private water companies and irrigation districts within their service areas." A.R.S. § 45-566(A)(5). The same conservation requirements were part of the Second Management Plan. A.R.S. § 45-565(A)(5).

In the Second Management Plan, private water companies and irrigation districts which distributed 20 percent or more of their total water deliveries for irrigation use by January 1, 1990 were required to reduce their irrigation distribution system lost and unaccounted for water either by lining all their canals or by operating their delivery systems so that the total quantity of lost and unaccounted for water is 10 percent or less of the total quantity of water withdrawn, diverted, or received during a year. These requirements become effective upon commencement of operation or by January 1, 2000, whichever is later. A Department review of the conservation practices of the largest irrigation districts located within AMAs has shown that the Second Management Plan distribution system conservation requirements are being achieved by most districts.

For the Third Management Plan, the irrigation distribution system conservation requirements established by the Second Management Plan will continue to apply to irrigation districts and private water companies which, as of January 1, 2000, distribute 20 percent or more of their total water deliveries for irrigation use. These irrigation districts and private water companies will be required to reduce their irrigation distribution system lost and unaccounted for water either by lining all their canals or by operating their delivery systems so that the total quantity of lost and unaccounted for water is 10 percent or less of the total quantity of water withdrawn, diverted, or received during a year. These requirements become effective upon the commencement of operation or by January 1, 2002, whichever is later. Until this time, the Second Management Plan irrigation distribution system conservation requirements will apply.

If a private water company or irrigation district has economic circumstances which prevent timely compliance with the irrigation distribution system conservation requirements, a variance of up to five years may be requested as provided by A.R.S. § 45-574. Information submitted in support of the variance request must include a complete water loss reduction plan, prepared by a registered civil engineer, which contains:

- A complete construction design document which shows specifications for repairing or modifying the irrigation distribution system. The document must include material specifications, proposed design specifications, installation and construction specifications, and any other engineering information or specifications necessary to complete the proposed rehabilitation of the distribution system.

- A detailed list of engineering costs and the proposed investment options designed to pay for the system improvements.

- The final completion date for the rehabilitation.

- If applicable, a system operating guide to reduce lost and unaccounted for water to a minimum. This guide may be modified as the rehabilitation progresses.

The procedures for obtaining a variance are described in Chapter 10, section 10.3.1.

4.4.3 Program Summary

The Department is adopting an Agricultural Conservation Program for the Third Management Plan that consists of two parts: the Historic Cropping Program and the Irrigation Distribution Systems Conservation Program, each of which is designed to help maintain safe-yield conditions in the Santa Cruz AMA. The Historic Cropping Program is a new program which the legislature authorized in 1998 through the enactment of A.R.S. § 45-566.02. Pursuant to this legislation, the irrigation efficiency used to calculate the maximum annual groundwater allotment for non-limiting soils is set at 75 percent and the flexibility account provisions of A.R.S. § 45-467 are restricted. The irrigation distribution system conservation requirements are essentially a continuation of requirements that were established for the Second Management Plan. These requirements are designed to assure that the amount of lost and unaccounted for water from water distribution systems is kept to a minimum. Both the Historic Cropping Program and the irrigation distribution system conservation program provide important tools for maintaining safe-yield conditions and preventing long-term declines in local water table levels in the Santa Cruz AMA. To further assist in maintaining these water management goals, the Department will also adopt a Base Program pursuant to A.R.S. § 45-566(A)(1) in the future.

4.5 NON-REGULATORY WATER RESOURCE MANAGEMENT STRATEGIES

In addition to the Agricultural Conservation Programs, there are other water resource management options which are available to achieve the water management goal for the Santa Cruz AMA. These options are described below.

4.5.1 Effluent

In 1991, the Legislature amended A.R.S. § 45-467 to exclude effluent from consideration in determining the amount of any debit to be registered to a farm's flex account. Laws 1991, Ch. 112, § 3. Under this amendment, a person using groundwater on a farm pursuant to an IGFR may use an unlimited amount of effluent on the farm without any debit being registered to the farm's flex account as a result of effluent use. In the Santa Cruz AMA, this provision only applies to effluent that is used directly. This provision does not apply to effluent that is withdrawn from a well. This amendment created an incentive for the use of effluent.

During the third management period, the Department will study alternative ways to increase the direct use of effluent. In the past, effluent utilization for agricultural irrigation has been limited primarily by the lack of necessary infrastructure. Other requirements, such as the wastewater reuse rules adopted by the Arizona Department of Environmental Quality, have limited the types of crops which can be irrigated solely by effluent. As effluent treatment techniques improve and more effluent becomes accessible to the agricultural sector, the Department expects that effluent use for agricultural purposes will increase.

4.5.2 Conservation Assistance Program

Non-regulatory efforts such as the Conservation Assistance Program have contributed to the reduction of agricultural water use in the AMAs. The Irrigation Conservation Assistance Program (ICAP), funded primarily by the Conservation Assistance Program, is currently in its fourth year of operation in the Tucson AMA. During the third management period, the ICAP may be extended into the Santa Cruz AMA to assist farmers in implementing conservation measures. The ICAP is a cooperative program with the Department, the Pima Natural Resources Conservation District, the USDA Natural Resources Conservation Service (NRCS), and more recently the United States Bureau of Reclamation (USBR). The ICAP provides irrigation scheduling and water application rate information to participating farmers. A computer program which integrates crop type, field and soil conditions, and weather conditions is used by ICAP to assist farmers in the conservation of water.

Conservation Assistance Program funds were also used in the Tucson AMA to produce a video entitled "Saving Water in Agriculture, Surface Irrigation." The production of this video was made possible through a cooperative effort between the Department, USBR, NRCS, and a private consultant. This video and accompanying manual is intended to educate farm managers and irrigators about efficient on-farm irrigation water management techniques. This video can be made available to interested farmers in the Santa Cruz AMA.

The use of Conservation Assistance Program monies to fund programs designed to assist the agricultural sector in the conservation of water resources is included in the Water Management Assistance Program of the Third Management Plan. The Department will continue to encourage programs which promote efficient agricultural water use. The Conservation Assistance Program is described more fully in Chapter 9.

4.6 FUTURE DIRECTIONS

To maintain safe-yield conditions and prevent long-term declines in local water table levels, new uses of water within certain areas of the Santa Cruz AMA will need to be offset either by replenishment of water withdrawn, or through a corresponding reduction in water use by existing users. Reduction in existing use could be achieved by discontinuing agricultural water use in the same local area in which a new demand begins. Water that is conserved through increased agricultural efficiency could, in part, be used by a new user.

During the third management period, the Department will continue to provide the agricultural sector with technical and conservation planning assistance to reduce overall demand and help meet the AMA goals. The Department will investigate incentives for the direct use of effluent, increasing the accuracy of water withdrawal measurement and improved irrigation scheduling and efficiency.

The Department will continue to work cooperatively with the agricultural community to determine appropriate conservation requirements under A.R.S. § 45-566(A)(1), and to develop additional alternative agricultural conservation programs in the Santa Cruz AMA for the third management period.

The Department will continue to support funding for conservation, education, and the direct use of effluent supplies in order to meet the water management goals of the Santa Cruz AMA. These monies may be used to assist farmers with irrigation water management practices and for the infrastructure to convey renewable water supplies to farms.

The Department will also continue to monitor crop and water use patterns during the third management period to evaluate agriculture's contribution to meeting the Santa Cruz AMA's dual goal and the impacts of the Department's programs on farming operations. Urbanization impacts on agriculture as well as water use trends due to agricultural market conditions will be evaluated for future planning needs.

4.7 AGRICULTURAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS

4-101. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, the following words and phrases used in sections 4-101 through 4-105 of this chapter shall have the meanings set forth below, unless the context otherwise requires:

1. *"Assigned Irrigation Efficiency" is defined as the maximum economically feasible levels of conservation within areas of similar farming conditions which each right holder is expected to achieve.*

2. *"Canal" is defined as a waterway constructed for the purpose of transporting water to a point of delivery, including main canals and lateral canals.*

3. *"Farm" is defined under A.R.S. § 45-402.*

4. *"Farm Unit" is defined under A.R.S. § 45-402.*

5. *"Flexibility Account" is an account maintained under A.R.S. § 45-467.*

6. *"Irrigation Acre" is defined under A.R.S. § 45-402.*

7. *"Irrigation Distribution System" is defined as a system of canals, flumes, pipes, or other works which are owned or operated by an irrigation district or private water company and used to deliver water for irrigation use.*

8. *"Irrigation Water Duty" is defined under A.R.S. § 45-566 which, for the Third Management Plan, is the total irrigation requirement to produce the crops historically grown divided by the assigned irrigation efficiency.*

9. *"Lost Water" is defined as water from any source, including effluent, which enters an irrigation distribution system and is lost from the system during transportation or distribution due to seepage, evaporation, leaks, breaks, phreatophyte use, or other causes.*

10. *"Maximum Annual Groundwater Allotment" is defined as the maximum amount of groundwater which may be used per year for the irrigation of each irrigation acre in the farm which is calculated pursuant to A.R.S. § 45-465.*

11. *"On-farm Seasonal Irrigation Efficiency" is defined as the total water requirements to produce a crop divided by the total quantity of water actually applied to that crop during one growing season.*

12. *"Total Quantity of Lost and Unaccounted for Water" is defined as the total quantity of water from any source, including effluent, withdrawn, diverted, or received by an irrigation district or private water company during a calendar year less the total deliveries of water from any source, including effluent, made by the irrigation district or private water company during the calendar year that are measured or estimated based on a generally accepted method of estimating water use.*

13. *"Water Duty Acres" is defined under A.R.S. § 45-461.*

4-102. Base Agricultural Conservation Program Requirements

Unless the owner of a Certificate of Irrigation Grandfathered Right (IGFR) is regulated under the Historic Cropping Program described in section 4-103, the IGFR owner and any person who is entitled to use groundwater pursuant to that IGFR shall continue to comply with the agricultural conservation requirements established by the Second Management Plan until the director adopts a Base Program for the Third Management Plan.

4-103. Historic Cropping Program

A. Application for Regulation under the Historic Cropping Program

Only an owner of an IGFR may apply to be regulated under the Historic Cropping Program. Beginning January 1, 2000, an application may be filed by an IGFR owner at any time prior to the first compliance date for the agricultural conservation requirements established in the Fourth Management Plan. An application for regulation under the Historic Cropping Program shall be on a form prescribed by the director and shall include the following information:

1. *The name, address, and phone number of the IGFR owner.*

2. *The number of the Certificate of Irrigation Grandfathered Right.*

3. *The name, address, and phone number of any person entitled to use groundwater under the IGFR.*

4. *For each of the three previous years, the number of acres and types of crops planted and the amount of water used to irrigate the planted acres.*

5. *For each of the three previous years, the type of irrigation system which has been used, including percent of slope, length of runs, and method of field application.*

6. *For each of the three previous years, a description of all water conservation practices used on the farm, including the name of any conservation program or irrigation water management service used on the farm.*

B. Criteria for Approval of Application

The director shall approve a complete and correct application for regulation under the Historic Cropping Program if the following requirements are satisfied:

1. *Any negative flexibility account balance in the farm's flexibility account does not exceed 25 percent of the maximum annual groundwater allotment in effect at the time that the application is made.*

2. *Any positive flexibility account balance in the farm's flexibility account does not exceed 75 percent of the maximum annual groundwater allotment in effect at the time that the application is made. In order to satisfy this requirement, the IGFR owner may sell or convey any excess credits as provided by A.R.S. § 45-467, or the IGFR owner may relinquish any excess credits.*

3. *The IGFR owner demonstrates that the average on-farm seasonal irrigation efficiency achieved on the farm's irrigation acres during the previous three years was 75 percent or greater. If the IGFR owner cannot demonstrate that an average on-farm seasonal irrigation efficiency of at least 75 percent has been achieved during the previous three years, the IGFR owner shall agree in writing to develop and implement at least one of the following:*

    a. *Enroll in a Department-sponsored or private irrigation management services program throughout the entire third management period or until the IGFR owner can demonstrate to the Department that an average on-farm seasonal irrigation efficiency of at least 75 percent has been achieved during the previous three years.*

    b. *Install a conservation system improvement, approved by the Department, designed to enable the IGFR owner to achieve an on-farm seasonal irrigation efficiency of at least 75 percent.*

C. Historic Cropping Program Requirements

An IGFR owner who has been approved for regulation under the Historic Cropping Program and any person using groundwater pursuant to that IGFR shall comply with the provisions of this section.

1. *The IGFR owner and any person entitled to use groundwater under that IGFR shall comply with the irrigation water duty and maximum annual groundwater allotment established by the director under this section, beginning with the calendar year in which the IGFR owner is accepted into the Historic Cropping Program, and continuing thereafter until the first compliance date for any substitute conservation requirement established in the Fourth Management Plan. The director shall establish the irrigation water duty and maximum annual groundwater allotment in the same manner that the director established the irrigation water duty and maximum annual groundwater allotment assigned to the IGFR in the Second Management Plan, except that the director shall use an assigned irrigation efficiency of 75 percent. In areas deemed by the director to have limiting soils, the director may use an assigned irrigation efficiency as low as 70 percent.*

2. *The IGFR owner, and any person entitled to use groundwater under that IGFR, may use the maximum annual groundwater allotment assigned to the IGFR to irrigate only the irrigation acres to which the IGFR is appurtenant.*

3. *The IGFR owner and any person entitled to use groundwater under that IGFR shall not use water for irrigation purposes during a calendar year in an amount which exceeds the maximum annual groundwater allotment assigned to the right, except as provided in the flexibility account provisions of A.R.S. § 45-467, as modified in subsection D of this section, and any rules adopted by the director.*

D. Flexibility Account Provisions

Under the Historic Cropping Program, the flexibility account provisions of A.R.S. § 45-467 shall apply to the IGFR owner and any person entitled to use groundwater under that IGFR with the following modifications:

1. *If the amount of water used to irrigate the farm in any year is less than the maximum annual groundwater allotment established for the farm pursuant to subsection C, paragraph 1 of this section, the amount of any credit registered to the farm's flexibility account pursuant to A.R.S. § 45-467 shall not exceed the difference between the existing balance in the account and a positive account balance of 75 percent of the maximum annual groundwater allotment. The director shall not register a credit to the farm's flexibility account in any year in which the account has an existing positive account balance equal to or greater than 75 percent of the maximum annual groundwater allotment.*

2. *The IGFR owner and any person entitled to use groundwater under that IGFR who are regulated under the Historic Cropping Program shall not:*

    a. *Purchase or sell flexibility account credits to another IGFR owner or any other person entitled to use groundwater under another IGFR regardless of whether they are regulated under the Historic Cropping Program.*

    b. *Transfer credits from the flexibility account of one farm to another farm even if the farms are owned by the same IGFR owner.*

3. *The maximum excess amount of groundwater that may be used pursuant to A.R.S. § 45-467 shall not exceed 25 percent of the maximum annual groundwater allotment established for the farm pursuant to subsection C, paragraph 1 of this section. The IGFR owner and any person entitled to use groundwater under that IGFR violate this section if the flexibility account maintained for the IGFR is in arrears at any time in excess of this amount.*

E. Reporting Requirements

In addition to the information required to be submitted in the annual report required by A.R.S. § 45-632, the IGFR owner and any person entitled to use groundwater pursuant to that IGFR shall submit the following information in the report:

1. *The name, address, and phone number of any person entitled to use groundwater under the IGFR.*

2. *The number of acres and types of crops planted and the amount of water used to irrigate the planted acres.*

3. *The type of irrigation system which has been used, including percent of slope, length of runs, and method of field application.*

4. *A description of all water conservation practices used on the farm, including the name of any conservation program or irrigation water management service used on the farm.*

F. Duration of Regulation under Historic Cropping Program

1. *Except as provided in paragraph 2 of this subsection, after the director approves an application for regulation under the Historic Cropping Program, the IGFR owner and any person entitled to use groundwater pursuant to that right shall be regulated under the Historic Cropping Program until the first compliance date for any substitute agricultural conservation requirement established in the Fourth Management Plan.*

2. *After the director approves an application for regulation under the Historic Cropping Program, the IGFR owner must remain in the Historic Cropping Program during the entire third management period except that a subsequent owner of the IGFR may file a written request to leave the Historic Cropping Program with the director within 90 days after acquiring an ownership interest in the IGFR. The director shall grant the request unless the director determines that the request is being made for the purpose of circumventing the provisions of paragraph 1 of this subsection, in which case the request will be denied. In the event that an IGFR is owned by more than one person, this paragraph does not apply unless all owners have conveyed their interests in the IGFR and all subsequent owners join in filing a written request with the director to leave the Historic Cropping Program.*

4-104. Conservation Requirements for Irrigation Distribution Systems

A. Applicability

The irrigation distribution system conservation requirements set forth in subsection B below apply to irrigation districts and private water companies which, as of January 1, 2000, distribute 20 percent or more of their total water deliveries for irrigation use.

B. Conservation Requirements

By January 1, 2002 or upon commencement of operation, whichever is later, and continuing thereafter until the first compliance date of any substitute requirement in the Fourth Management Plan, each irrigation district and private water company owning or operating an irrigation distribution system shall either:

1. *Line all canals used to deliver water for irrigation use with a material that allows no more lost water than a well-maintained concrete lining, or*

2. *Operate and maintain its distribution system so that the total quantity of lost and unaccounted for water is 10 percent or less of the total quantity of water from any source, including effluent, withdrawn, diverted, or received by the irrigation district or private water company on either a calendar year basis or a three-year average basis based on that calendar year and the two preceding calendar years.*

4-105. Monitoring and Reporting Requirements for Irrigation Districts and Private Water Companies

A. Applicability

The monitoring and reporting requirements set forth in subsection B below apply to irrigation districts and private water companies which, as of January 1, 2000, distribute 20 percent or more of their total water deliveries for irrigation use.

B. Monitoring and Reporting Requirements

For calendar year 2002 and for each calendar year thereafter until the compliance date for any substitute requirement in the Fourth Management Plan, each irrigation district and private water company owning or operating an irrigation distribution system shall submit in its annual report required by A.R.S. § 45-632, the following information as it applies to the irrigation district or private water company:

1. *A map showing the irrigation distribution system, including those portions which have lined canals and those portions which have unlined canals, unless a current map is on file with the Department.*

2. *The number of miles of lined canals and the number of miles of unlined canals in the irrigation distribution system.*

3. *The total quantity of water from any source, including effluent, which was withdrawn, diverted, or received by the irrigation district or private water company during the calendar year.*

4. *The total quantity of water from any source, including effluent, delivered by the irrigation district or private water company to all water users during the calendar year.*

5. *An estimate of the irrigation district's or private water company's total quantity of lost and unaccounted for water for the calendar year. This quantity shall be determined by a generally accepted engineering method.*

APPENDIX 4
CONSUMPTIVE USE AND OTHER NEEDS BY CROPS[1]
SANTA CRUZ ACTIVE MANAGEMENT AREA

Crop	Consumptive Use (acre-feet per acre)	Other Needs (acre-feet per acre)
Grain Crops		
Barley	1.83	-----
Corn, Grain	2.50	-----
Maize (Sorghum)	2.17	-----
Oats, Grain	1.83	-----
Rye	1.83	-----
Sorghum, Grain	2.17	-----
Wheat	1.83	-----
Field Crops		
Castor Beans	3.70	-----
Cotton	2.58	-----
Peanuts	-----	-----
Pinto Beans	1.17	-----
Safflower	-----	-----
Soybeans	-----	-----
Orchard Crops (Nut)		
Pecans, without Groundcover	3.58	-----
Pecans, with Groundcover	-----	-----
Pistachios	3.50	-----
Forage Crops		
Alfalfa[2]	3.42	-----
Bermuda Grass	3.42	-----
Hay, Annual (Non-Alfalfa)	1.50	-----
Native Pasture	1.75	-----
Permanent Pasture (Fescue)	4.67	-----
Sudan Grass	1.50	-----
Vegetable Crops		
Carrots	-----	.75
Chili Peppers	2.33	.50
Corn, Sweet	1.42	.87
Lettuce, All	.71	2.44

APPENDIX 4
CONSUMPTIVE USE AND OTHER NEEDS BY CROPS[1]
SANTA CRUZ ACTIVE MANAGEMENT AREA

Crop	Consumptive Use (acre-feet per acre)	Other Needs (acre-feet per acre)
Onions, Dry	-----	.75
Tomatoes, All	-----	.50
Vegetables, Mixed	-----	.50
Fruit		
Apricots	3.00	-----
Cantaloupe, Late	1.33	.50
Citrus, All	-----	-----
Grapes	2.50	.50
Peaches	-----	-----
Plums	-----	-----
Watermelons	-----	.50
Miscellaneous Crops		
Jojoba	-----	
Christmas Trees	2.25	
Nursery Stock	-----	

[1] Based on crops that were reported in the 1975 to 1980 history.
[2] Based an average historical high yield for Santa Cruz County of 5.5 tons per acre.

Sources: Consumptive Use of Water by Major Crops in Southwestern United States. Conservation Research Report #29, Agricultural Research Service, USDA, (1982).

FAO Irrigation and Drainage Paper # 24, Food and Agriculture Organization of the United Nations (revised 1977).

APPENDIX 4 *(continued)*
ASSIGNED CONSUMPTIVE USE (CU) VALUES FOR CROPS ASSOCIATED WITH FARM UNITS LESS THAN 10 ACRES SANTA CRUZ ACTIVE MANAGEMENT AREA

HIGH CONSUMPTIVE USE CROPS

Crops with a CU value of 3.60 acre-feet per acre or more are assigned a CU value of 4.50 acre-feet per acre.

Alfalfa
Pecans (with and without Groundcover)
Permanent Pasture (Fescue)
Pistachios

MEDIUM CONSUMPTIVE USE CROPS

Crops with a CU value of 2.25 to 3.60 acre-feet per acre are assigned CU value of 3.00 acre-feet per acre.

Apricots	Grapes	Peaches
Bermuda Grass	Guayule	Peanuts
Corn, Grain	Jojoba	Plums
Cotton	Nectarines	Rappini
Citrus, All	Nursery Stock	Safflower
Chili Peppers	Olives	Sorghum (Grain, Double Cropped)
Christmas Trees	Okra	Sugar Beets

LOW CONSUMPTIVE USE CROPS

Crops with a CU value less than 2.25 acre-feet per acre are assigned a CU value of 2.00 acre-feet per acre.

Barley	Cucumbers, All	Mixed Vegetables	Rye
Beets, Table	Ensilage	Native Pasture	Sorghum, Grain
Broccoli	Hay, Annual (Non-Alfalfa)	Oats, Grain	Sudan Grass
Cabbage, All		Onions, All	Summer Squash and Zucchini
Cantaloupe, All	Lettuce, All	Parsnips	
Carrots	Maize	Pinto Beans	Tomatoes, All
Cauliflower	Melons, All	Potatoes	Turnips and Rutabaga
Corn, Sweet	Misc. Vegetables	Radishes	Wheat

CHAPTER

5

Municipal Conservation Program

5.1 INTRODUCTION

The primary goal of the Municipal Conservation Program is to assist the Santa Cruz Active Management Area (AMA) in maintaining safe-yield conditions by gradually reducing per capita water consumption, encouraging the best available water conservation practices, and maximizing the efficient use of water. The Arizona Department of Water Resources (Department) supports the efficient use and equitable distribution of water in an environmentally and economically sound manner through long-range planning, cooperative regional efforts, technical assistance, and regulatory programs. The efficient use and replenishment of water sources will help prepare the Santa Cruz AMA water users for periods of prolonged drought and assist in preserving economic development in this area.

The Department recognizes that the Municipal Conservation Program alone will not maintain the goals of the Santa Cruz AMA in the long term. During the third management period, additional water management strategies will be examined that may result in a modification of this plan. These strategies could include the redistribution of water for municipal purposes during periods of prolonged drought, replenishment or storage of excess water during periods of above average precipitation, increased emphasis on improvements in distribution systems to reduce lost and unaccounted for water and increased water conservation education, and implementation of water conservation measures during periods of hot weather and low rainfall. A seasonal versus an annual water management approach may also be examined. Some of the potential water management strategies will be outside the context of the management plan, but will be included in other programs implemented by the Department including the Assured Water Supply Program (AWS Program) and Well Spacing Rules. Additional water management programs may be implemented by entities outside the Department such as a water replenishment district that may be formed in the Santa Cruz AMA.

Statutory tools may not be currently available to implement alternative management approaches. In this case, legislative changes would need to precede a management plan modification to incorporate newly authorized programs. This process could take several years to complete.

Municipal water providers in the Santa Cruz AMA include one city, several private water companies, a few mobile home and/or recreational vehicle parks, and several miscellaneous municipal users, that deliver water withdrawn from wells for non-irrigation uses such as residential, commercial, governmental, industrial, and construction uses. Municipal water providers can also include well cooperatives and irrigation and improvement districts. The Department regulates municipal providers serving more than 250 acre-feet of water for non-irrigation use annually as large municipal providers. Those providers serving 250 acre-feet or less annually are regulated as small municipal providers. Large and small providers have different conservation and reporting requirements. Appendix 5A contains a list of all the large and small municipal water providers in the Santa Cruz AMA as of 1998.

The municipal sector accounts for about a third of the total Santa Cruz AMA water use. Between 1985 and 1995 population growth rates in the AMA averaged more than five percent per year. Population is expected to continue to increase by two to three percent per year during the third management period with a corresponding increase in municipal water demand. The Assured Water Supply Rules (AWS Rules) adopted by the Department in 1995, which apply to all five AMAs, do not contain criteria for the Santa Cruz AMA for proving consistency with the AMA goals. The AWS Rules will be modified to include these criteria as the goals for the Santa Cruz AMA are further defined. Modifications to the AWS Rules addressing consistency with goal criteria will require new development to demonstrate that it will be consistent with the maintenance of safe-yield conditions and prevention of long-term declines in local water table levels in the AMA. A.A.C. R12-15-705. The AWS Program is expected to have a significant impact on water management in the municipal sector during the third management period.

Reductions in the gallons per capita per day (GPCD) water use rates of large municipal providers are required by the Groundwater Code (Code). Conservation programs instituted by water providers in response to regulatory requirements of the First and Second Management Plans have not resulted in achieving the GPCD reductions that were expected. A series of hot, dry years in the mid-1990s and high rates of water losses in some years have contributed to a fluctuating AMA average GPCD rate since 1990. Increased conservation efforts and additional water management options are needed in order to maintain safe-yield conditions and prevent long-term declines in local water table levels in the Santa Cruz AMA.

This chapter contains the following sections:

- Statutory Provisions
- AWS Program
- First and Second Management Plans
- Municipal Program Issues
- Third Management Plan Municipal Conservation Program
- Non-Regulatory Efforts
- Future Directions

5.2 STATUTORY PROVISIONS

5.2.1 Per Capita Requirements for Large Municipal Providers

The Code requires that the management plans for each AMA include a conservation program for municipal uses. For the First, Second, and Third Management Plans, the Code expressly mandates that the programs require reasonable reductions in per capita use. A.R.S. §§ 45-564(A)(2), 45-565(A)(2), and 45-566(A)(2). As originally enacted, the Code did not exempt any municipal providers from the requirement to achieve reductions in per capita use. Consequently, the Municipal Conservation Program in the First Management Plan established maximum GPCD requirements for all municipal providers, regardless of size.

In 1986, the Legislature amended the statutes governing the Second and Third Management Plans to exempt "small municipal providers" from the requirement to achieve reasonable reductions in per capita use. Laws 1986, Ch. 107, §§ 2 and 3. Instead of requiring small municipal providers to achieve reductions in per capita use, the statutes require the director to establish "reasonable conservation requirements for small municipal providers." A.R.S. §§ 45-565(A)(4) and 45-566(A)(4). Until 1994, "small municipal provider" was defined in the Code as "a city, town, private water company or irrigation district that supplies water for non-irrigation use, serves less than five hundred people and supplies less than one hundred acre-feet of water for non-irrigation use during a calendar year." Laws 1986, Ch. 107, § 1. In 1994, the Legislature changed the definition of small municipal provider to "a municipal provider that supplies 250 acre-feet or less of water for non-irrigation use during a calendar year." A.R.S. § 45-561(13).

Two other statutory amendments have created exceptions to the requirement that municipal providers achieve reasonable reductions in per capita use. In 1991, the Legislature exempted large untreated water providers from the requirement to achieve reductions in per capita use. Laws 1991, Ch. 211, §§ 16, 17, and 18. However, there are no large untreated water providers in the Santa Cruz AMA. In 1992, the Legislature enacted legislation requiring the director to include in each management plan a Non-Per Capita

Conservation Program (NPCCP) for large municipal providers as an optional, alternative program to the program requiring reductions in per capita use. Laws 1992, Ch. 183, §§ 5, 7, and 9. The latter amendment is described in greater detail in the following two sections.

5.2.2 Non-Per Capita Conservation Requirements for Large Municipal Providers

Each provider regulated under the NPCCP is required to implement specific residential and non-residential conservation programs for interior and exterior water use, a public education program relating to water conservation, and a program to meter most service area connections. Additionally, providers who are regulated under the NPCCP are required to either reduce their groundwater pumping consistent with the AWS Rules (A.A.C. R12-15-701, *et seq.*) or eliminate their use of mined groundwater by the year 2010. The NPCCP is a performance-based program with compliance determined by the effective implementation of stipulated conservation measures and the required groundwater use reduction. For the Third Management Plan, the statutory requirements for the NPCCP are found at A.R.S. § 45-566.01.

5.2.3 Conservation Requirements for Individual Users

In addition to requiring the director to establish conservation requirements for municipal providers, the Code requires the director to establish in the Third Management Plan "such other conservation measures as may be appropriate for individual users." A.R.S. § 45-566(A)(2). An "individual user" is a person or entity who receives water from a municipal provider for a non-irrigation use to which specific conservation requirements apply. In the Third Management Plan, the director has established conservation requirements for the following individual users: (1) turf-related facilities, (2) large-scale cooling facilities, and (3) publicly-owned rights-of-way.

A municipal provider that receives notice of an individual user conservation requirement is responsible for complying with the requirement with respect to all individual users to which it serves water and to which the requirement applies, with two exceptions. First, the municipal provider is not responsible for complying with the requirement with respect to an individual user that has received notice of the requirement directly from the director. In that case, the individual user is responsible for complying with the requirement. Second, if the requirement is substantially identical to an industrial conservation requirement, the municipal provider is not responsible for complying with the requirement with respect to an individual user which it has identified in writing to the Department by a specified date. If the individual user was in existence when the management plan was adopted, the municipal provider must have identified the individual user to the Department at least 90 days before the management plan was adopted. A.R.S. § 45-566(B). If the individual user came into existence after the management plan was adopted, the municipal provider must identify the individual user to the Department within 90 days after it begins serving water to the individual user. If the municipal provider identifies a new individual user to the Department more than 90 days after it begins serving water to the individual user, the municipal provider will be responsible for complying with the individual user requirement until the end of the year in which it first identifies the user to the Department. See section 5-111 of the municipal conservation requirements.

5.2.4 Distribution System Requirements

The director is required to include in the Third Management Plan "additional economically reasonable conservation requirements for the distribution of water, other than stored water, withdrawn from wells, for cities, towns, private water companies and irrigation districts within their service areas." A.R.S. § 45-566(A)(5). Distribution system requirements for municipal providers consist of a requirement to limit lost and unaccounted for water and a requirement to meter deliveries. See section 5-112 of the municipal conservation requirements.

5.3 ASSURED WATER SUPPLY PROGRAM

The Code requires persons proposing to offer subdivided lands for sale or lease within an AMA to demonstrate that the proposed subdivision has an assured water supply. A.R.S. § 45-576. If a subdivider fails to demonstrate that a proposed subdivision has an assured water supply, the plat for the subdivision may not be approved by a city, town, or county, and the State Real Estate Commissioner may not issue a public report authorizing the sale or lease of the subdivided lands. A.R.S. § 45-576(B) and (C).

There are two mechanisms for demonstrating that a proposed subdivision has an assured water supply. First, the subdivider may apply for and obtain a Certificate of Assured Water Supply (Certificate of AWS) from the director. Second, the subdivider may obtain a written commitment of water service for the subdivision from a city, town, or private water company which the director has designated as having an assured water supply. A.R.S. § 45-576(A). For both of these purposes, "assured water supply" means that sufficient water of adequate quality will be continuously available to meet the water needs of the proposed use for at least 100 years; that the projected use is consistent with the management plan and achievement of the management goals for the AMA; and that the financial capability has been demonstrated to construct the water facilities necessary to make the supply of water available for the proposed use, including a delivery system and any storage facilities or treatment works. A.R.S. § 45-576(I).

In 1995, the Department adopted rules to carry out the purposes of the assured water supply statute. A.A.C. R12-15-701, *et seq*. The AWS Rules specify in detail what an applicant for a Certificate of AWS or a Designation of Assured Water Supply (Designation of AWS) must demonstrate. Of particular relevance to the Municipal Conservation Program are the requirements for demonstrating that a proposed use is consistent with the management plan and achievement of the management goal for the AMA.

5.3.1 Consistency With Management Goal

Because the timing of the adoption of the AWS Rules coincided with the creation of the Santa Cruz AMA, the current AWS Rules do not address the unique goal of the AMA to maintain safe-yield conditions and prevent long-term declines in local water table levels. The AWS Rules must be modified to include provisions which will assist in maintaining the goals of the Santa Cruz AMA.

5.3.2 Consistency with Management Plan

In order to demonstrate consistency with the AMA's management plan, the AWS Rules generally require that an applicant be in compliance with its management plan requirements. For municipal providers, the applicable management plan requirements are the municipal conservation requirements set forth in section 5.10 of this chapter. Thus, if a municipal provider applying for a Designation of AWS is regulated under the Total GPCD Program, the provider must either be in compliance with its total GPCD requirement or with the terms of a stipulation and consent order entered into to remedy non-compliance with the GPCD requirement in order to demonstrate consistency with the management plan. *See* A.A.C. R-12-15-706(B).

An applicant for a Certificate of AWS is not subject to the municipal provider conservation requirements set forth in the management plan because the applicant is not a municipal provider as defined in A.R.S. § 45-561. However, certain uses that may be associated with a certificate application, such as turf-related facilities and landscaping or water features in publicly owned rights-of-way, are subject to the individual user requirements in sections 5-111(A) of the municipal conservation requirements if water withdrawn from wells, other than stored water, will be used. For all individual users, whether served by a designated or undesignated provider, either the entity delivering water or the individual user (e.g., homeowners association, turf-related facility owner, etc.) will be responsible for compliance with the individual user requirements.

The water use of a new subdivision will also affect a large municipal provider's ability to meet its GPCD target. While individual users or the entity delivering water to them are responsible for meeting the individual user requirements, new subdivisions should be developed in a manner consistent with the conservation requirements in the management plan. This could be accomplished by some relatively simple and voluntary efforts by the certificate applicant or the homebuilder. A few examples are:

- Establish Conditions, Covenants, and Restrictions or other conditions that will limit landscaping within the subdivision
- Provide lot buyers with written water conservation information, including irrigation management of automatic irrigation timers
- Landscape model homes in accordance with Xeriscape™ principles
- Feature state of the art water conservation fixtures and appliances in model homes
- Limit high water use vegetation in common areas to those areas that provide significant recreational benefits
- Provide low water use landscaping packages to home buyers
- Design simple water harvesting features in landscaping designs
- Locate hot water heaters to minimize long hot water pipe runs or install looped systems
- Include community pools in large developments as an alternative to individual home pool installation

The application for a Certificate of AWS requires submittal of general information to allow the Department to estimate the water demand of the subdivision. This general information includes submittal of any Conditions, Covenants, and Restrictions or other conditions that will limit exterior water demand and any proposed conservation practices, policies, devices, etc. that may be utilized.

5.3.2.1 Consistency With Management Plan Criteria For Applicants For Certificates Of Assured Water Supply

Some subdivisions may include a golf course and other non-residential water uses. Demands associated with non-residential use are considered to be part of the subdivision offering if they will be part of the common promotional plan and they are covered by the official definition of a subdivision (A.R.S. § 32-2101). A golf course may be the single largest water use associated with the needs of a development. An 18-hole golf course typically uses enough water on an annual basis to meet the needs of more than 2,400 households in the Santa Cruz AMA. Because of this large volume of water, a person applying for a Certificate of AWS that includes a golf course within the development plan must demonstrate the following:

> That any new golf courses to be included within the development plan will be designed to comply with any applicable turf-related facility conservation requirements contained in Chapter 6 of this management plan. To make this demonstration, the applicant shall describe in its application the design and landscaping plans for any golf courses that will be included within the development.

When the AWS Rules are revised, more specific Consistency with Management Plan requirements for Certificates of AWS may be included.

5.3.3 Assured Water Supply Role in the Municipal Conservation Program

After the AWS Rules are modified to incorporate Santa Cruz AMA goal criteria, the municipal sector water demand is anticipated to be managed in a more secure and long-term fashion. Contingency planning for drought as well as management of supplies to allow for future growth and protect existing water users will improve the security of the water supply. However, difficulties in obtaining secure long-term supplies may persist in the AMA. Municipal providers must cope with institutional and geographic constraints in managing water supplies. Physical management of water supplies is outside of the current scope of the management plan or the AWS Rules; however, the creation of a water bank or district could address water distribution and securing or firming of water supplies in local areas of the Santa Cruz AMA.

5.4 FIRST AND SECOND MANAGEMENT PLANS

Until 1994, the Santa Cruz AMA was included as a portion of the Tucson AMA and was managed under the safe-yield goal mandated for the Tucson AMA. For the First and Second Management Plans, the Department was required by statute to focus on per capita reductions as a mechanism to move the municipal sector toward safe-yield. Reductions in GPCD rates result in conservation of the water supply. To achieve these reductions, the Total GPCD Program was established as the base program for all municipal providers.

The Department began with a basic percentage reduction approach in the First Management Plan and moved to addressing each provider's unique water use characteristics in the Second and Third Management Plans. In each management period, the Department has addressed additional water management concerns through technical assistance, new incentives for the use of renewable supplies, and corrections to data and assumptions based on the availability of new data and technologies. In addition to the Total GPCD Program, voluntary alternative programs that were not based solely on per capita reductions were developed in the Second Management Plan for providers able to limit or reduce reliance on groundwater supplies. The intent of these programs is to allow providers more flexibility in managing water demand in exchange for their commitment to limit groundwater use. While programs to limit strictly groundwater use may have limited applicability in the Santa Cruz AMA, the option for regulation under alternative programs is still applicable due to variations in water service area demand characteristics and distribution systems.

5.4.1 First Management Plan Approach

The approach to municipal conservation in the First Management Plan was to incrementally reduce the water use by all providers toward an ultimate target of 140 GPCD. The higher the calculated GPCD rate of a particular provider, the greater the required reduction in per capita use. The 1980 census population and total water use were used to calculate each provider's 1980 GPCD rate, from which a total GPCD requirement was calculated that moved the provider one quarter of the way from its 1980 GPCD rate to 140 GPCD. Providers at or under 140 GPCD in 1980 were not required to conserve further but were not permitted to use more than 140 GPCD per year.

This approach to GPCD reductions assumed that all providers had the same potential to reduce per capita water use in their service area. Providers were given the opportunity to request a modification of their total GPCD requirement if they considered them unreasonable or if there were technical or factual errors in calculating the requirement.

Both small and large municipal water providers were regulated in the same manner in the First Management Plan. In addition, there was a "Special Provider" category for service areas which were dominated by non-residential/institutional uses whose water use patterns and conservation potential could not be adequately characterized by per capita rates. These special providers were assigned a residential GPCD requirement and specific conservation requirements for non-residential uses.

5.4.2 Second Management Plan Approach

During development of the Second Management Plan, the Department took into account the unique situations and growth patterns within each service area that influence the provider's ability to reduce per capita use. It was recognized that new users should be more efficient than existing users due to low-flow plumbing fixture ordinances and the trend toward installation of low water use landscapes. It was also recognized that existing users with high water use rates had greater conservation potential than those with lower water use rates.

The approach to setting GPCD requirements for large municipal providers in the Second Management Plan was based on an analysis of conservation potential for each service area using 1985 as the base year. Conservation potential for existing residential uses was estimated by comparing existing water use patterns to assumed levels of savings that could accrue by implementing selected conservation programs which had been successfully implemented in Arizona, California, and other regions in the United States. These savings were applied to the existing residential GPCD rate for each large municipal provider to develop a per capita target for existing residential uses. New residential uses were assumed to come in at a model water use rate that reflected low water use landscaping practices and low flow plumbing fixtures. Non-residential uses were held constant from base year levels. The full allotment for existing turf-related facilities was allowed. The percentage of lost and unaccounted for water was assumed to stay at the base year level. However, if it was under five percent, it was assumed to be at five percent; and, if it was over 10 percent, it was assumed to be at 10 percent.

Providers whose base year GPCD rate was under a certain level were not required to conserve further, while those with relatively high GPCD rates were assumed to have greater conservation potential. A total GPCD requirement was established for each large municipal provider combining the assumptions for existing residential, new residential, non-residential, turf-related facility use, and lost and unaccounted for water. A final and two intermediate per capita requirements were set for each water provider in an attempt to encourage providers to make progressive conservation efforts throughout the management period.

Because non-residential uses may continue to increase and, in most cases, are not subject to Certificate of AWS requirements limiting groundwater use, modifications to the total GPCD requirement for disproportionate increases in non-residential growth were not allowed in the Second Management Plan. To address this, the Department established the Alternative Conservation Program (ACP) which regulates providers based on a residential per capita requirement and the implementation of specific non-residential conservation measures. In order to participate in this more flexible program, providers were required to limit their groundwater withdrawals to a historic level, which required them to utilize renewable supplies or retire groundwater rights to serve the remaining demand.

Additionally, providers that served predominantly non-residential/institutional uses were allowed to apply for the Institutional Provider Program (IPP) which replaced the "Special Provider" program in the First Management Plan.

In the Second Management Plan, small municipal providers were not assigned a total GPCD requirement. Instead, they were required to comply with the following requirements: minimize waste, maximize efficiency of outdoor watering, encourage reuse, and reduce the GPCD rate in their service areas.

5.4.3 Overview of Changes During the Second Management Period

Since 1990, the Second Management Plan has been modified twice. In general, changes were made to the Municipal Conservation Program to provide incentives for use of non-groundwater sources, to encourage conservation through a grants program, and to add a non-per capita conservation program. Additionally, a legislative change created an incentive for municipal providers to use groundwater withdrawn pursuant to approved remedial action projects.

5.4.3.1 Management Plan Modifications

5.4.3.1.1 First Modification (1992)

An exclusion for the use of untreated Central Arizona Project (CAP) water was included in the first modification. Providers that were willing to make a commitment to ultimately serve effluent to a non-residential customer, but did not yet have access to it, were allowed to serve untreated CAP water to the customer without having that water counted in the total GPCD rate for up to 10 years. This incentive was adopted to encourage construction of the necessary non-potable distribution system before the effluent is available so that service of effluent will begin sooner.

The Conservation Assistance Grants Program was adopted to provide financial, planning, technical, and other support and services to all regulated sectors. Each year grants are awarded to support education, projects, and research that promote water conservation. The funds to support the grants program come from a portion of the groundwater withdrawal fee paid by all regulated water users in each AMA.

5.4.3.1.2 Second Modification (1995)

Legislation passed in 1994 and incorporated into the second modification redefined small municipal providers as those providers serving 250 acre-feet of water or less annually. Small municipal providers had previously been defined as those serving 100 acre-feet of water or less annually or serving a population of 500 people or less. The intent of this legislation was to focus conservation efforts on providers with higher water use and greater conservation potential. In the Santa Cruz AMA, passage of this legislation reduced the number of large municipal providers from five to three. However, by 1996 one small provider had transitioned back into the large municipal provider category.

The NPCCP, adopted by the Legislature in 1992 and incorporated into the second modification, exempts qualified large municipal providers from per capita conservation requirements by substituting reasonable conservation measures (RCMs) that target both residential and non-residential users in place of per capita requirements. A.R.S. § 45-565.01(A). Providers who elect to enter this program are required to substantially reduce the use of mined groundwater in their service area. As the third management period progresses, it may become clear that the NPCCP, requiring reductions in groundwater dependency, is not helpful to the Santa Cruz AMA in maintaining its goals. If that is the situation, a statutory change may be sought to adjust the groundwater reduction requirement of the NPCCP to a requirement that is effective in addressing the AMA water management goals.

The second modification provided an incentive for the use of renewable supplies by allowing large municipal providers whose annual groundwater use is 30 percent or less of their total annual water use to remain at or below their Second Management Plan First Intermediate GPCD requirement. This incentive could be used in each year that the provider achieved the groundwater limitation standard of 30 percent or less, through the year 1999.

5.4.3.2 Legislative Change

The Santa Cruz AMA was created in 1994 from the southernmost portion of the Tucson AMA. The unique hydrologic characteristics of the AMA (see Chapter 2) and the dual management goal of the AMA require a water management strategy different from the other four AMAs in the state. In late 1997, the Department finished drafting a concept paper that describes not only the hydrologic characteristics of the area, but also issues and possible water management programs, including rules and regulations. The process used to develop these ideas has depended on significant public input, and public input will be sought throughout the refinement of these regulatory programs, up to final adoption. Criteria for the consistency with goal requirement of the AWS Rules and water replenishment options are yet to be developed and adopted which relate specifically to the water management goals of the Santa Cruz AMA. Preliminary criteria for the location of new and replacement wells in the Santa Cruz AMA are included in this plan; however, additional criteria will need to be developed and the criteria contained in this plan may be updated and adopted through a management plan modification. The Third Management Plan will be adopted before the rest of these accompanying rules, regulations, and programs are fully developed, reviewed by the public and adopted. The Third Management Plan will also need to be modified for those programs that overlap with the management plan. The municipal program is connected to additional well spacing, recharge and assured water supply provisions yet to be adopted.

In 1997, legislation was enacted providing an incentive for municipal providers to use groundwater withdrawn pursuant to an Environmental Protection Agency (EPA) or Arizona Department of Environmental Quality (ADEQ) "approved remedial action" project. Prior to the passage of this bill, the withdrawal and use of groundwater, regardless of its quality, was counted as groundwater use in the determination of compliance with the management plan conservation requirements (see Chapter 10). This legislation requires the Department to account for remediated groundwater withdrawn pursuant to an approved remedial action project in the same manner as surface water for determining compliance with the management plan conservation requirements. Thus, this groundwater is counted as surface water in the compliance determination. Laws 1997, Ch.287, § 51(B). Although the legislation did not expressly apply to conservation requirements adopted in the Second Management Plan, the Department has indicated through a substantive policy statement that it will apply the incentive to Second Management Plan conservation requirements. Section 5.7 contains a discussion of this incentive as it applies to the Third Management Plan.

5.5 MUNICIPAL PROGRAM ISSUES

Throughout the preparation of the Third Management Plan, extensive input was obtained from the municipal water use sector to identify issues and concerns that need to be addressed during the third management period. This section summarizes the key issues and concerns raised by the Department and by water providers in these discussions. These issues have been taken into consideration in program development. Some issues require legislative change or other actions not under the Department's control.

5.5.1 Private Water Company Issues

Some municipal water providers regulated under the Municipal Conservation Program are privately-owned companies separate from the city, town, or county in which they are located. While local plumbing and landscape ordinances may apply within the private water company service area, the water company itself lacks the authority to enact or enforce ordinances regulating water use by its customers. In addition to being regulated by the Department, private water companies are regulated by the Arizona Corporation Commission (ACC), an elected body whose mission includes exercising exclusive state regulatory authority over public service corporations (public utilities) in the public interest. The ACC monitors the operations of approximately 350 private water utility companies throughout Arizona, reviewing company financial records and recommending revenue requirements and rates and charges to be collected. The regulatory responsibilities of the ACC are fully defined in Article XV of the Arizona Constitution and §§ 40-201, *et seq.*, Arizona Revised Statutes, including A.R.S. § 40-250, requiring that all public service corporations obtain ACC approval before establishing or changing any rate.

Private water companies have raised several issues regarding the relationship of the Department's requirements and the ACC's view of rate recovery associated with the requirements. The most significant issues identified include: (1) the perception of uncertainty in the ability to recover the holding costs of CAP subcontracts and financing the construction of facilities for receipt and use of renewable supplies and (2) the impact of the ACC's position in rate cases that implementation of conservation programs is discretionary because the Department does not identify and mandate specific conservation programs or measures needed to be carried out by the provider.

These issues have been extensively reviewed and discussed by the Department staff, private water company representatives, and ACC staff. The ACC has indicated that "although they cannot guarantee recovery of costs prior to their incurrence" they would consider cost recovery for the use of renewable supplies and the implementation of conservation measures, applying the principles of "used and useful" and "least-cost alternative." In the past, these principles have meant that a provider would have to be actively providing a resource in order to recover costs and any conservation measure implemented would have to be the most cost-effective option before the recovery of costs would be allowed. Private water companies argue that these principles do not guarantee cost recovery as they are considered by the ACC on a case-by-case basis.

During the development of the Third Management Plan, the Department explored the possibility of establishing a municipal conservation program designed specifically for private water companies. In order to meet the goals of the Department and obtain the support of the ACC, the Department considered a program which would mandate specific conservation measures and reduce reliance on groundwater supplies, especially in the Phoenix, Tucson, and Prescott AMAs. It was determined that additional statutory authority would be needed to implement such a program and the Department decided not to pursue this action at this time. However, Department staff, with the cooperation of the regulated community, will continue to explore options, including continued dialogue between the two agencies aimed at establishing a united strategy to achieve the most economically efficient reduction in groundwater reliance (generally in Phoenix, Tucson, and Prescott AMAs) by private water companies and providing more certainty of cost recovery.

5.5.2 Use of Renewable Water Supplies

In the Younger Alluvium of the Santa Cruz River, where most of the water demand is concentrated in the Santa Cruz AMA, groundwater, surface water, surface water subflow, and effluent that flows on the surface and as subflow are commingled and combine to fill the available storage in the Younger Alluvium. Therefore, renewable supplies are not available to the Santa Cruz AMA in the same sense that they are available in the Phoenix, Tucson, and Pinal AMAs; from large surface water reservoirs or from the Colorado River via the CAP canal. During prolonged periods of precipitation, the Younger Alluvium storage is filled and water in excess of the storage capacity of the Younger Alluvium is not captured and continues through the AMA.

Because the Santa Cruz River basin extends into Mexico, water withdrawals for and effluent generated by demands in Nogales, Sonora can impact the water availability in the Younger Alluvium of the Santa Cruz AMA. Without additional sources of water brought into the AMA, renewable supplies are essentially limited to natural recharge from precipitation events and the discharge of effluent from Mexico.

Use of renewable water supplies in the Santa Cruz AMA are dissimilar to Phoenix, Tucson, and Pinal AMAs in that no incentive is needed to encourage water users to transition from one source of supply to another. Instead, water management efforts in the Santa Cruz AMA relative to renewable water supplies must hinge on refilling the storage capacity in the Younger Alluvium and protecting the net natural recharge that occurs along the mountain fronts.

A number of incentive programs for the use of renewable supplies were included in the Second Management Plan and some are included in this plan (see Chapter 8 for a summary of all incentives). These incentives are based on the philosophy of the Phoenix, Tucson, and Pinal AMAs that groundwater use should be transitioned to use of a renewable supply. For example, in the Third Management Plan effluent used directly or recovered within the area of impact does not count in the GPCD calculation.

Several other incentives were considered for inclusion in the Third Management Plan. None of these incentives is completely applicable to the water supply conditions in the Santa Cruz AMA. During the third management period, the Department may modify the Third Management Plan for the Santa Cruz AMA to include water management incentives that are appropriate for this AMA.

In the meantime, the option of extinguishing recharge credits or storing non-recoverable water in particular areas as a compliance mechanism may be considered during the third management period, even in advance of a violation. Providers who anticipate an allotment violation are encouraged to develop a proactive response program in cooperation with the Department (see section 10.7.3 of Chapter 10). Since there are currently no recharge credits accrued in the Santa Cruz AMA, it is unclear whether this type of option would be meaningful for the Santa Cruz AMA.

5.5.3 Assured Water Supply Issues

The AWS Rules in general apply to all AMAs, including the Santa Cruz AMA, but consistency with AMA goal criteria have yet to be developed for the Santa Cruz AMA. The AWS Rules will have to be modified to include this component. In the meantime, assured water supply applications are being reviewed based on the best available information. The Department is still improving its understanding of hydrologic characteristics in the Santa Cruz AMA and is expanding its database for use in a hydrologic model. While the model will assist in refining some characteristics of the AMA hydrology, it will not be able to answer all water management or hydrologic questions. Interpretation will still be used. As a greater understanding of the hydrology of the AMA is gained, the AWS Rules may be modified to include additional criteria. This means that new development must be evaluated extremely carefully and that a conservative approach is prudent.

5.5.4 Total Gallons Per Capita Per Day Program Issues

Municipal providers are responsible for ensuring efficient water use by their customers including: single family (single family homes or mobile homes on their own lots); multifamily (apartments, town homes, patio homes, duplexes, triplexes, master metered permanent resident mobile home parks); commercial (stores, shopping centers, and malls); industrial (golf courses, cemeteries, factories, schools, parks); government (city or county office buildings and associated grounds); and construction (dust control, metered fire hydrant use during road or highway work). For providers regulated under the Total GPCD Program, compliance is determined by comparing the provider's actual GPCD use rate with the provider's total GPCD requirement for the year.

When the Second Management Plan total GPCD requirements were assigned in 1990, the Department received many requests for administrative review. Adjustments were requested for a number of reasons including inaccurate population projections, seasonal population, historical disproportionate increases in non-residential growth, and inaccurate assumptions for new residential growth.

Population projections for 1992, 1995, and 2000 were one of the factors used in the Second Management Plan to calculate total GPCD requirements for each large municipal provider. There are several uncertainties associated with using population projections in the total GPCD calculations. The economic forecast at the time the projections are developed can influence the projections, the ratio of single family to multifamily projections can influence the per capita water use rate, and the way a provider actually grows in relation to the projections can either make it easier or more difficult for a provider to meet its requirements.

To address these uncertainties in the Third Management Plan, population projections will not be used to calculate a total GPCD requirement. Instead, an annual GPCD requirement will be calculated using a component method that uses actual new single family and multifamily populations at model use rates combined with water use components for existing residential, non-residential, existing turf-related facilities, and lost and unaccounted for water. This approach is discussed in more detail in section 5.6.1.1 of this chapter.

Seasonal visitors, those customers not maintaining a legal residence in the State of Arizona, do not count as resident service area population in GPCD calculations due to the definition of resident population used by the Census Bureau. This population can skew GPCD rates to make it appear that water use is becoming more or less efficient, depending on whether or not the proportion of seasonal population to resident population is decreasing or increasing. Providers that can demonstrate a significant impact due to seasonal population can request an administrative review of the annual population estimate.

The practice of water providers reporting the number of service connections rather than the actual number of housing units served can also result in inaccurate GPCD calculations because it will result in an inaccurate population estimate. This may occur in areas where one service connection serves more than one housing unit at the address as when manufactured homes are installed or removed from an existing meter or when a primary residence has a guesthouse attached to the same meter.

The ratio of residential to non-residential demand can also impact the GPCD rate of a water provider. Adding a new large non-residential customer can drastically increase overall water demand and negatively impact a provider's ability to achieve compliance with the total GPCD requirement. The First Management Plan contained a provision which allowed a provider experiencing a disproportionate increase in non-residential use to apply for a modification to its total GPCD requirement to accommodate the increased non-residential use. Although the Second Management Plan did not contain this provision, it did contain other provisions which allowed a provider to remain in compliance while serving disproportionately increasing non-residential uses. For example, delivery of effluent, other than effluent recovered outside the area of impact of an underground storage project, was excluded when determining a provider's compliance with its GPCD requirement. Thus, a provider could serve an unlimited amount of effluent to a non-residential customer without the service having any impact on its GPCD rate. Additionally, the ACP and the NPCCP were developed in the Second Management Plan to allow the non-residential sector to grow without per capita restrictions if renewable water supplies were used. In the Third Management Plan, the Department will continue to offer alternative programs and an effluent use incentive to allow for flexibility to address disproportionate non-residential growth.

5.5.5 AMA Issues

There has been a concern that water use by small, private domestic wells (not more than 35 gallons per minute pump capacity) in the AMA represents a significant unreported demand and threat to the local portion of the AMA goal. As of 1998, about 1,300 small or "exempt" wells were registered within the Santa Cruz AMA, although the exact number of actual exempt wells has not been verified. While many of these wells are entitled to withdraw up to 56 acre-feet of water per year, it is unlikely that the amount of withdrawal per well averages anywhere near this volume for several reasons. First, the sheer number of registered wells is not representative of the actual number of wells that were completed and on which a pump was installed. Many on the list of 1,300 registered wells may be duplicates, may not have been drilled, may have been drilled but may not have found water, or may never have been put to use. While the Department requires information on the completion of wells within AMAs, site inspections of exempt wells occur less frequently than inspections of large wells, due to the limited impact and volume of small wells. Second, 56 acre-feet of water per well is a considerable volume of water when water use patterns of individual well owners are analyzed. Municipal providers in the Santa Cruz AMA average just under 190 GPCD. The average number of persons per household in Santa Cruz County pursuant to the 1990 U.S. Census was about 3.5 persons per occupied housing unit. This is less than one acre-foot per well per year. Most exempt wells provide water for one household, but it is conceivable that an exempt well could be shared among more than one household.

The Department developed an estimate of exempt well water demand for the Third Management Plan. Of the more than 1,300 exempt wells registered in the Santa Cruz AMA, a complete data record exists for just over 800. These wells were examined based on their geographic distribution within the AMA. These wells were categorized based on three geographic locations: the Younger Alluvium of the Santa Cruz River, the older alluvium of the Santa Cruz River, and the Nogales Formation. Each of these wells was assumed to serve an average of 1.5 households with an average of 3.5 persons per household (the 1990 U.S. Census figure for the Nogales County Control Division). At an assumed GPCD rate of 186, the total residential demand of all of these wells would be approximately 900 acre-feet per year. In addition to this residential demand, there are about 20 wells located within the Younger Alluvium of the Santa Cruz River that are known to maintain less than two acres of pasture or other small cropped areas. The use for irrigation of these areas is estimated to be just over 200 acre-feet per year. Therefore, the total estimated demand associated with the number of exempt wells in existence within the Santa Cruz AMA as of late 1997 is about 1,100 acre-feet per year.

Additional exempt wells are registered in the Santa Cruz AMA listing an intended use of stock-watering. It is difficult to estimate the potential demand from an exempt well for stock-watering in the Santa Cruz AMA for several reasons. First, many ranchers own or lease land near the Santa Cruz River and cattle drink directly from the river. Second, many stock ponds fill naturally during summer and winter rains and do not need to be constantly filled using the well. Third, the Department does not maintain records of the number of cattle within the AMA that utilize stock ponds. And, finally, the Department has not verified how many of the exempt wells used for stock watering are actually in use or used for that purpose.

5.6 THIRD MANAGEMENT PLAN MUNICIPAL CONSERVATION PROGRAM

Conservation requirements have been established pursuant to the statutory provisions of the Code for large municipal providers and small municipal providers. This section details the programs and requirements that have been developed for the Third Management Plan.

5.6.1 Conservation Requirements for Large Municipal Providers

In order to establish conservation requirements for large municipal providers in the Second Management Plan, the Department identified existing water use patterns and service area characteristics that influence a provider's water conservation potential. Assumptions about future service area population growth and water supply and demand were also included in the analysis. This assessment was referred to as the "municipal provider profile." Using population projections for 1992, 1995, and 2000, targets for each water use sector or component (existing residential, new residential, non-residential, turf-related facility, and lost and unaccounted for water) were combined to establish a preassigned total GPCD requirement. Two intermediate requirements in 1992 and 1995 were established to allow a phase-in to achieve the final Second Management Plan requirement in 2000.

For the Third Management Plan, the Department used a similar approach to identify water use characteristics. Information obtained from annual water use reports included water deliveries, monthly water use by sector, water source, and number of housing units added to the service area annually. Additional information included: (1) annual population estimates based on the provider-supplied housing unit information from the annual reports, (2) Department of Economic Security persons per housing unit data, and (3) individual interviews with water providers to assess existing water conservation programs and determine water conservation potential.

In the Third Management Plan, the Department will not use population projections in combination with water use components to preassign total GPCD requirements. Instead, each component is assigned a separate water use rate, and a total GPCD requirement will be calculated each year based on actual population growth within each service area. As in the Second Management Plan, there will be two intermediates and a final GPCD requirement for all large municipal providers. Each large municipal provider will be noticed of its GPCD components for their service area and the method for calculating a total GPCD requirement. Providers may apply for a variance from or an administrative review of the conservation requirements within 90 days after the notice is given.

As an alternative, a large municipal provider may apply to be regulated under the NPCCP, the ACP, or the IPP. The following sections describe the base Municipal Conservation Program and how it was developed and briefly describes the alternative conservation programs.

5.6.1.1 Total Gallons Per Capita Per Day Program

As in previous management periods, the base municipal program for the Third Management Plan is the Total GPCD Program. All large municipal providers regulated under this program must limit the overall GPCD water usage within their service areas to the amount allowed under their total GPCD requirements.

For the third management period, an annual total GPCD requirement will be calculated for each water provider using a component method. The components of the total GPCD requirement are existing residential use, new residential interior use, new single family residential exterior use, new multifamily residential exterior use, turf-related facility use, non-residential use, and lost and unaccounted for water. Each large provider has an assigned per capita per day or per housing unit per day component use as shown in Table 5-5 of section 5.10 or described in section 5-103.B. The component calculation is described in more detail in Appendix 5C.1-2. The sum of the component volumes for each provider will be multiplied by the actual population or housing units in the service area each year to determine the annual total GPCD requirement for the provider. The resulting allowable volume will be compared to the actual amount of water withdrawn, diverted, or received in the calendar year to determine whether the water provider is in compliance.

5.6.1.1.1 Total Gallons Per Capita Per Day Program Development

Existing Residential Conservation Potential

Conservation potential is an estimate of the amount of reduction in water use that may result from implementing conservation measures or programs. To determine the existing residential conservation potential of each large municipal provider in the Second Management Plan, the Department used a base year to determine water use rates for existing residential water users, and then analyzed residential water use patterns and selected appropriate conservation programs. This analysis resulted in a GPCD reduction for existing users that was factored into the total GPCD requirement for the provider. In developing the Third Management Plan, staff conducted a detailed analysis of all assumptions used to estimate the conservation potential of existing residential users in the Second Management Plan. This included an extensive inventory and analysis of available water conservation devices, measures, and programs. Adjustments were made to the Second Management Plan assumptions on water savings, market penetration, and installation rates based on documented water savings from water conservation programs throughout the United States, including the southwest.

The average monthly water use for the years 1992 through 1995 was used to determine the conservation potential for existing residential water use in the Santa Cruz AMA. The "base year" data for each provider are shown in Appendix 5D. Four categories of water use were established to indicate existing residential interior and exterior conservation potential. Depending on the average interior and exterior water use within each service area, providers were categorized as having no potential, minimum potential, moderate potential, or maximum potential as shown in Table 5-1.

TABLE 5-1
SANTA CRUZ ACTIVE MANAGEMENT AREA EXISTING RESIDENTIAL CONSERVATION POTENTIAL CATEGORIES
SANTA CRUZ ACTIVE MANAGEMENT AREA

Category	Interior GPCD	Single Family Exterior GPHUD	Multi-family Exterior GPHUD
No Potential	≤57	≤75	≤6
Minimum Potential	58-74	76-107	7-26
Moderate Potential	75-87	108-135	27-58
Maximum Potential	>87	>135	>58

GPCD = gallons per capita per day
GPHUD = gallons per housing unit per day

The Department assigned appropriate conservation measures to the minimum, moderate, and maximum categories that could be implemented to achieve water savings commensurate with the provider's conservation potential. Additionally, the Department evaluated existing conservation programs within each service area and, based on this information, the conservation savings assigned to a provider were adjusted to take into account programs already implemented. The water savings associated with each conservation measure were applied to the provider's water use characteristics to calculate the existing residential component.

Models for New Residential Users

For new residential water users, those residential users who begin to receive water from a municipal provider after 2000, the Department utilized a similar model-based approach to that used in the Second Management Plan. Current water fixture flow rates, existing technology, and behavioral patterns were evaluated and incorporated into updated models for new interior and exterior water use. In addition, data from several residential water use studies and surveys conducted during the second management period were used to develop the Third Management Plan models.

The interior residential water use model was updated to reflect performance specifications for toilets, showerheads, and faucet aerators in current local, state, and federal plumbing codes; use of water-efficient clothes washers and dishwashers; and documented, typical water use behavioral patterns. It should be noted that low-flow toilet requirements limit water use to 1.6 gallons per flush; however, to compensate for occasional double-flushing, the model rate for toilets was adjusted to 1.7 gallons per flush. A miscellaneous water use component was added to the Third Management Plan model to allow for reasonable water consumption associated with fixtures and appliances not specifically addressed as model components. Behavioral patterns affecting the duration and frequency of use of plumbing fixtures and water using appliances were reevaluated based on data obtained from residential flow trace studies conducted in the Phoenix area and other communities throughout the United States and Canada sponsored by the American Water Works Association Research Foundation. As a result, an interior residential model use rate of 57 GPCD, a 4 GPCD decrease from the Second Management Plan model of 61 GPCD, will be used as an interior component for all new residential water users through the third management period (see Table 5-2). Detailed assumptions used to establish the interior residential water use model are described in Appendix 5E.

TABLE 5-2
THIRD MANAGEMENT PLAN
INTERIOR WATER USE MODEL FOR NEW RESIDENTIAL DEVELOPMENT
SANTA CRUZ ACTIVE MANAGEMENT AREA

Device	Model Assumption	Model Use Rate
Toilet	5 flushes/person/day * 1.7 gallon/flush	9 GPCD
Shower/Bath	(2.5 gpm * 7.9 min/shower * 0.9 shower/person/day) + (32.5 gal/bath * 0.1 bath/person/day)	21 GPCD
Faucets	Kitchen & Bathroom 2.5 gpm* 4 minutes/person/day	10 GPCD
Dishwasher	9.8 gal/load * 0.2 loads/person/day	2 GPCD
Clothes Washer	30.3 gal/load * 0.3 loads/person/day	9 GPCD
Miscellaneous		6 GPCD
TOTAL		**57 GPCD**

Note: Figures are rounded

The exterior water use model for new single family development for the second management period considered average swimming pool demand, evaporative cooling demand, and efficient water application for typical landscaping. The same approach, using updated information, was used for the Third Management Plan. Because exterior water use is largely independent of the number of persons per household, the exterior model is expressed in gallons per housing unit per day (GPHUD). The approach for the third management period assumes that the same potential exists for all new housing units to implement landscaping patterns appropriate to the local climate and practice efficient water application. Thus, a single model for all new single family residential development was used.

In 1997, the Department conducted a survey of outdoor water use practices at new housing in cooperation with the University of Arizona, Tucson Water, and Metropolitan Domestic Water Improvement District (Craft, 1997). Responses were received from occupants of over 600 single family residences built since 1991. The results of the survey provided valuable information on the frequency of installation of evaporative coolers, swimming pools, pool covers, and spas; the size and number of gardens and turf areas; and the number and types of landscaping plants typical of new housing. In 1996, the Phoenix AMA provided funding for a survey of evaporative cooler use which was performed by the University of Arizona in conjunction with the City of Phoenix (Karpiscak, et al., 1998). Findings from these studies were also used to develop the exterior model. Landscape water use and landscaping design assumptions are based on the potential for the provider to promote the use of, provide incentives for, and educate new residents about the benefits of using low water use plants and practicing efficient landscape watering. Efficient landscape watering techniques include the use of drip irrigation systems and proper water application scheduling.

In addition to the Phoenix AMA evaporative cooler study and the Tucson AMA landscape survey, other data used in developing the exterior residential model were a review of common landscape patterns in new homes in the Nogales and Rio Rico service areas, a survey of swimming pool and spa contractors and owners, a compilation of Santa Cruz AMA evapotranspiration and rainfall data, University of Arizona horticultural research data, and a landscape watering schedule developed by the Pima County Cooperative Extension Service (Pima County Cooperative Extension Service, 1996). Although it is recognized that not all homeowners will meet the model use rate individually, it is anticipated that new per capita water use on average over an entire service area will conform to the model rate. It was assumed that new homes have the potential to implement appropriate landscaping practices and that providers have a stronger ability to influence a new homeowner's decisions than those in an established neighborhood.

The model rate for new single family exterior residential water use is 107 GPHUD in the Third Management Plan. The new multifamily exterior residential water use model is 26 GPHUD. Table 5-3 summarizes the assumptions used to develop the single family exterior water use model for the Third Management Plan. Table 5-4 summarizes the assumptions used to develop the exterior water use model for multifamily residential development. Details of the assumptions are contained in Appendix 5F.1-3.

TABLE 5-3
EXTERIOR WATER USE MODEL FOR NEW SINGLE FAMILY RESIDENTIAL DEVELOPMENT
SANTA CRUZ ACTIVE MANAGEMENT AREA

	Model Use Rate
Pool Use	4 GPHUD
Spa Use	0 GPHUD
Evaporative Cooling	5 GPHUD
Landscape Watering	98 GPHUD
Single Family Residential Exterior Total	**107 GPHUD**

GPHUD = gallons per housing unit per day

TABLE 5-4
EXTERIOR WATER USE MODEL FOR NEW MULTIFAMILY RESIDENTIAL DEVELOPMENT
SANTA CRUZ ACTIVE MANAGEMENT AREA

	Model Use Rate
Pool Use	0 GPHUD
Spa Use	0 GPHUD
Evaporative Cooling	5 GPHUD
Landscape Watering	21 GPHUD
Multifamily Residential Exterior Total	**26 GPHUD**

GPHUD = gallons per housing unit per day

Non-Residential Water Use

The Third Management Plan base year, composed of the average annual non-residential water use from 1992 to 1995 exclusive of water served to turf-related facilities, was evaluated and compared to the Second Management Plan base year use. In general, the lower of the two base year numbers was used to set the Third Management Plan non-residential per capita component. Long-term residential and non-residential growth are typically proportionate in most service areas. Those large water providers experiencing dramatically disproportionate long-term non-residential growth may apply for the ACP or the NPCCP. In both of these programs, constraints on non-residential GPCD are removed in return for a commitment from the water provider to take steps to assist in the achievement of the AMA water management goal and to encourage all customer classes to practice maximum water use efficiency. In the Third Management Plan, the Department will continue to regulate certain non-residential customers of municipal water providers as individual users including turf-related facilities, large-scale cooling facilities, and landscaping and water features in public rights-of-way as described in section 5-111 of the municipal conservation requirements.

Turf-Related Facility Water Use

In the Second Management Plan, the maximum annual water allotment of a turf-related facility was factored into a water provider's total GPCD requirement if that turf-related facility was in existence by December 26, 1984 and was served groundwater by that provider. The allotments for turf-related facilities that were developed after the mid-1980s were not factored into a water provider's total GPCD requirement. As a result, new turf-related facilities were expected to be served with effluent. Any use of groundwater on a new turf facility had the effect of reducing the amount of groundwater that could be served to other customers of the water provider if the provider was to meet its total per capita requirement. If an existing turf-related facility converted from groundwater to another water supply such as effluent or if the provider no longer served the facility, the maximum annual allotment for the facility was still factored into the provider's total GPCD requirement.

In both the Second and Third Management Plans in years when the existing turf-related facility uses less than its full allotment, the balance of the allotment is available for the provider to serve other uses. In years with higher water demand, an existing turf-related facility can use water in excess of its allotment, within the credit and debit limits in the provider's flexibility account, without adversely impacting the per capita compliance status of the provider. However, the turf-related facility is still required to meet its allotment requirement in order to be in compliance with the conservation requirements for turf-related facilities (see section 6.3.8 of Chapter 6). In the Santa Cruz AMA, if a provider replaces deliveries of water withdrawn from wells to a turf-related facility with direct delivery of effluent, the provider benefits by: (1) not having the effluent delivery count in its GPCD rate when determining compliance and (2) by retaining the volume of the turf-facility allotment in the calculation of its total GPCD requirement. This provides a substantial incentive to providers to serve effluent.

In a manner similar to that in the Second Management Plan, the combined maximum annual water allotments for Second Management Plan existing turf-related facilities are factored into the annual calculation of the provider's per capita requirement as the turf-related facility component in the Third Management Plan. This component is factored into the annual requirement if the water provider converts from serving water withdrawn from wells, other than stored water, to serving any other source of water. However, if the provider no longer serves the facility, the allotment is not included in the turf-related facility component. For example, if the golf course is owned by a homeowners' association which decides to discontinue water service from the provider and serve the existing facility through recovery of CAP recharge credits, the maximum annual water allotment for the golf course is not included in the water provider's turf-related facility component. In the Second Management Plan, the provider would have retained the volume of the allotment in its total GPCD requirement under this scenario. As in the Second Management Plan, allotments for new turf-related facilities are not factored into the calculation of a provider's GPCD requirement. The Third Management Plan approach is designed to discourage development of new turf-related facilities that are dependent on water withdrawn from wells, other than stored water, and to prevent water providers from receiving an allotment of water for facilities they no longer serve. Appendix 5G lists the turf-related facilities that are included in the turf-related facility component for water providers. The component will be adjusted if a water provider no longer serves the facility.

This approach assumes that new golf courses within service areas will be served with direct use effluent or effluent recovered within the area of impact, which are not counted in determining compliance with gallons per capita per day requirements. Additional water withdrawn from wells, other than stored water, for new turf-related facilities is not allocated in the turf-related facility component, which is combined with the other components in the calculation of a provider's total gallon per capita per day requirement. However, there may be cases where direct use effluent and effluent recovered within the area of impact will not be physically available to serve a new turf-related facility, or cases where such effluent will eventually be used but is not currently available, or not available in sufficient quantity. In these cases, an existing large municipal provider may apply for an administrative review.

In the case where direct use effluent and effluent recovered within the area of impact will not be physically available to serve the new turf-related facility within a reasonable period of time, the provider will receive a permanent adjustment to its per capita requirement, if effluent recovered outside the area of impact of the storage is used to serve the new facility. In the case where direct use of effluent or effluent recovered within the area of impact is committed to serve the facility and delivery of the effluent will be initiated within four years, but a longer period is necessary for sufficient effluent to be produced to serve the entire facility, the provider will receive a temporary adjustment to its total GPCD requirement with no requirement to use effluent recovered outside the area of impact during the transition period. The adjustment will remain in effect only until sufficient direct use effluent or effluent recovered within the area of impact is available to serve the entire facility, not to exceed eight years, and may be adjusted as the volume of effluent use increases. The adjustment will be terminated if the infrastructure necessary to deliver the effluent to the facility is not in place at the beginning of the fourth year after the provider commences service to the facility.

In either case, the adjustment will consist of an addition to the provider's turf-related facility component in the amount of the turf-related facility's allotment as calculated under the conservation requirements in Chapter 6. However, no adjustment will be granted above a volume that would allow the provider to use more water for non-residential use during a year than an amount calculated by multiplying the provider's base period non-residential GPCD use rate (including turf-related facility use), or 21 GPCD, whichever is higher, by the provider's service area population for the year, then by the number of days in the year.

Lost and Unaccounted for Water

In the Third Management Plan, large municipal providers must limit the amount of water that is lost and unaccounted for in their distribution systems each year to no more than 10 percent of all water withdrawn, diverted, or received in that year. Second Management Plan per capita requirements were held to lost and unaccounted for water use rates in the base year. Providers with less than 10 percent lost and unaccounted for water in the base year were assumed to be able to maintain this lower rate throughout the second management period. Because the Third Management Plan regulatory standard is 10 percent for all providers, those with lower loss rates will be allowed their actual lost and unaccounted for water each year up to the 10 percent limit in the calculation of the provider's annual total GPCD requirement.

5.6.1.1.2 Total Gallons Per Capita Per Day Compliance

Each provider's compliance with the Total GPCD Program will be determined annually by comparing the provider's actual annual volumetric usage of all water (except effluent used directly and stored effluent that is recovered within the area of impact) withdrawn, received, and diverted for non-irrigation use to the volume of water permitted by summing the components. The amount of water permitted is the amount of water the provider could legally withdraw, divert, or receive during the year for non-irrigation use, calculated by multiplying the provider's total GPCD requirement for the year by the provider's service area population as of July 1 of the year and then multiplying the product by the number of days in the year.

Any credits or debits in the provider's flexibility account will be taken into account when determining compliance as discussed below.

Flexibility Account

To account for the impacts of weather variations on municipal water use, the Department established a municipal flexibility account for each large provider in the Second Management Plan to determine compliance with the total GPCD requirement. This same approach will be used to determine compliance with total GPCD requirements in the Third Management Plan. Under the flexibility account approach, if a water provider uses less water in a year than is allowed by its total GPCD requirement, a credit is registered to the provider's flexibility account in the amount of the difference. If a provider uses more water during a year than allowed by its total GPCD requirement, a debit is registered to the provider's flexibility account in the amount of the difference. The maximum credit accumulation is 30 GPCD. The maximum debit accumulation is 10 GPCD. The provider is considered out of compliance with its total GPCD requirement if the debit accumulation exceeds 10 GPCD.

Annual Population Estimates

At the beginning of the management period, the initial service area population for each water provider is calculated using the latest Census numbers, which are disaggregated by unit type (single family, multifamily) to determine the base or "existing" housing unit count. Each year water providers are requested to report the total number of new housing units added to the service area. The reported new units are added to the "existing" housing units to derive the total housing unit figure for that year. Occupancy rates and persons per occupied housing unit rates from the latest Census are applied to the housing unit count to derive an estimated service area population.

5.6.1.2 Non-Per Capita Conservation Program

The NPCCP was added to the Second Management Plan in 1995 after being developed in cooperation with representatives of the water using community. This program requires a provider to implement specific conservation measures within its service area instead of requiring compliance with per-capita conservation requirements. A provider in this program must implement RCMs for interior and exterior residential water uses, interior and exterior non-residential uses, as well as an education program. The RCMs must be designed to result in water use efficiency within the provider's service area equivalent to the water use efficiency assumed in the provider's total GPCD requirement.

The Department has established a list of standard RCMs which are designed to achieve an efficiency equivalent to the assumptions used in the Total GPCD Program. However, if the standard RCMs do not fit the service area characteristics of a provider, the program allows the provider the flexibility to substitute measures that are designed to achieve the same savings yet fit the characteristics of the provider's service area. For the third management period, the Department will establish a steering committee to assist the Department in reviewing the existing standard RCMs, the substitute RCMs, and development of monitoring and reporting requirements which would be beneficial to the administration of the alternative programs. This steering committee will be primarily made up of Department staff, representatives of large municipal providers that are regulated under an alternative program, and any other members who the director considers to be necessary.

5.6.1.2.1 Groundwater Use Reduction Requirement

The provider must meet one of the following requirements to be eligible to participate in the NPCCP: (1) the provider must be a member of a groundwater replenishment district, (2) the provider must be designated as having a 100-year assured water supply under the Department's AWS Rules, or (3) the provider must implement a plan to eliminate mined groundwater withdrawals by 2010. Because the statute creating the NPCCP was put in place prior to the creation of the Santa Cruz AMA, these eligibility requirements are not necessarily workable or meaningful for the Santa Cruz AMA. During the third management period, the Department will examine the eligibility requirements for the NPCCP and determine whether additional requirements should be developed that are more appropriate for the Santa Cruz AMA and its water management goals.

5.6.1.2.2 Reasonable Conservation Requirements

A set of Standard Residential, Non-Residential, and Education RCMs were developed by the Department with the aid of an advisory group composed of conservation program experts. Each RCM prescribes actions that must be taken by the provider to achieve water use efficiencies in each water use category. Providers who have already implemented these measures will be required to implement additional conservation measures to qualify for the program consistent with their existing conservation potential. Standard RCMs include interior, exterior, and education measures and are described in Appendix 5H.1-3. Substitute RCMs (Appendix 5H.4) were developed to allow a provider to develop a conservation program tailored to the characteristics of its service area.

In order for a provider to use a Substitute RCM in place of a Standard RCM, the provider must apply to the director and demonstrate that the Substitute RCM will be designed to achieve a water use efficiency equivalent to the Standard RCM.

Standard RCMs

A. Residential Interior
   1. Water Audit and Fixture Retrofit Program for Existing Residential Customers
   2. Ordinance or Condition of New Service Prohibiting Installation or Replacement of Plumbing Fixtures in Residential Housing Units Unless Fixtures Meet Water Savings Standards

B. Residential Exterior
   1. Audit Program for Existing Residential Customers
   2. Landscape Watering Advice Program for Existing and New Residential Customers
   3. Ordinance or Conditions of New Service for Model Homes in New Residential Developments
   4. Prohibit the Creation of Covenants, Conditions, and Restrictions Which Require the Use of Water-Intensive Landscaping or Which Prohibit the Use of Low Water Use Landscaping in New Residential Developments
   5. *One additional landscape RCM from the three below(choice of one of the following):*
      (1) Ordinance or Condition of New Service Limiting Use of Turf and Other Water-Intensive Landscaping in New Multifamily Developments, **or**
      (2) Ordinance or Condition of New Service Limiting Use of Turf and Other Water-Intensive Landscaping in Common Areas of New Single Family and Multifamily Developments, **or**
      (3) Rebate Program for New Residential Customers

C. Non-Residential Interior
   1. Interior Audit Program for Existing Facilities
   2. Ordinance or Condition of New Service Prohibiting Installation or Replacement of Plumbing Fixtures in Non-Residential Facilities Unless Fixtures Meet Water Savings Standards
   3. Distribution of Conservation Information to all New Non-Residential Customers and Submittal of Water Use Plan by New Large Facilities

D. Non-Residential Exterior
   1. Exterior Audit Program for Existing Non-Residential Customers

2. Landscape Ordinance or Condition of New Service for New Facilities

E. Education
1. Public Information and Education Program

5.6.1.2.3 Compliance with the Non-Per Capita Conservation Program

A provider regulated under the NPCCP is in compliance with the program if it implements the agreed to RCMs and limits its use of groundwater to the amount allowed under the AWS Rules or the amount allowed under the straight-line reduction, whichever is applicable. The Department will use the written agreement for the NPCCP to monitor progress with the program. Each year, along with the Annual Water Withdrawal and Use Report, the municipal provider will be required to submit a progress report describing the implementation of each RCM, the cost of implementing the program, estimated or actual water savings, and a description of any difficulties with the program. Providers regulated under the NPCCP will also be required to comply with the individual user, distribution system, and monitoring and reporting requirements contained in this chapter.

5.6.1.3 Alternative Conservation Program

The ACP was developed for the Second Management Plan to give large municipal providers with disproportionately increasing non-residential water use an alternative to the Total GPCD Program. The program allows providers with disproportionately increasing non-residential water use the flexibility to serve those non-residential uses while achieving water use efficiency levels comparable to those set by the Total GPCD Program. The ACP consists of the following requirements: (1) a consistency with management goal demonstration, (2) a residential GPCD requirement, and (3) non-residential RCMs. As of 1998, there were no Santa Cruz AMA providers in the ACP.

5.6.1.3.1 Consistency with Management Goal Demonstration

In order to qualify for the ACP, a large municipal provider must demonstrate that withdrawals of water from a well, other than stored water, will meet the consistency with management goal requirements of the AWS Rules.

5.6.1.3.2 Residential GPCD Requirement

Each provider regulated under the ACP is required to comply with a residential GPCD requirement that is calculated using the GPCD and GPHUD components for existing residential, new single family and new multifamily water users. These components are derived using the same methodology as that used to calculate the residential portion of the total GPCD requirement. The residential GPCD requirement is recalculated annually based on growth within the service area using the same calculation used for the residential components of the Total GPCD Program. The residential GPCD calculation methodology is described in Appendix 5I.

5.6.1.3.3 Reasonable Conservation Measures

Providers regulated under the ACP must implement specific conservation measures for non-residential water users. Providers who have already implemented these measures will be required to implement additional conservation measures to qualify for the program. The non-residential requirements for the Third Management Plan have been modified and are now identical to the interior and exterior non-residential requirements for the NPCCP. The requirements are as follows:

A. Non-Residential Interior

1. Interior Audit Program for Existing Facilities
2. Ordinance or Condition of New Service Prohibiting Installation or Replacement of Plumbing Fixtures in Non-Residential Facilities Unless Fixtures Meet Water Savings Standards
3. Distribution of Conservation Information to all New Non-Residential Customers and Submittal of Water Use Plan by New Large Facilities

B. Non-Residential Exterior

1. Exterior Audit Program for Existing Non-Residential Customers
2. Landscape Ordinance or Condition of New Service for New Facilities

Providers may also request a substitute measure for any non-residential requirements to be approved by the director.

5.6.1.3.4 Compliance with the Alternative Conservation Program

A provider regulated under the ACP is in compliance with the program if it does not exceed its residential GPCD requirements, implements the agreed to non-residential RCMs, and is consistent with the AMA goal under the AWS Rules. The Department will use the written agreement for the ACP to monitor progress with the program. Each year, along with the Annual Water Withdrawal and Use Report, the municipal provider will be required to submit a progress report describing the implementation of each non-residential RCM, the cost of implementing the program, estimated or actual water savings, and a description of any difficulties with the program. Providers regulated under the ACP will also be required to comply with the individual user, distribution system, and monitoring and reporting requirements contained in this chapter.

Consistency with Management Goal Criteria

A large municipal provider regulated under the ACP is in compliance with the consistency with management goal criteria if it complies with the consistency with management goal criteria of the AWS Rules for the Santa Cruz AMA.

Residential GPCD Requirement

Compliance with the residential GPCD requirement will be determined in a manner similar to that used to determine compliance with the total GPCD requirement. As in the Total GPCD Program, there is a flexibility account for providers regulated under the ACP. However, because the requirement only applies to residential GPCD use, the maximum positive balance is 21 GPCD and the maximum negative balance is 7 GPCD. The residential GPCD use rate will be compared to the residential GPCD requirement plus any credits or minus any debits accrued in the flexibility account. The residential GPCD requirement will be calculated on an annual basis by adding together the assigned residential components. Providers with an annual GPCD rate that exceeds the maximum flexibility account debit will be considered out of compliance with the residential GPCD requirement.

Non-Residential Requirement

A provider regulated under the ACP is in compliance with the non-residential requirement if it implements the agreed to standard non-residential RCMs or any substitute non-residential RCMs approved by the director.

5.6.1.4 Institutional Provider Program

The IPP in the Second Management Plan replaced the special provider category in the First Management Plan and is continued in the Third Management Plan. The IPP allows those providers with primarily non-residential type uses and who are unable to economically utilize renewable water supplies to be regulated under a program that focuses on the specific water use characteristics of their service area. The IPP is designed for large municipal providers who supply more than 90 percent of their total water deliveries to non-residential water users. Specifically, these non-residential uses include prisons, hospitals, military installations, airparks, and schools. A provider may request admission to this program by submitting an application in writing to the director at any time during the third management period. If the request is approved, the provider will be assigned conservation measures specific to the non-residential uses in its service area and a maximum residential GPCD rate. The Department will grant institutional provider status only if the Total GPCD Program is not appropriate and the provider demonstrates that it cannot qualify for the ACP requirement to be consistent with the AMA goal or the NPCCP by limiting its groundwater use, retiring grandfathered groundwater rights, or using alternative sources of water. As described in section 5.6.1.2.1, the applicability of these qualifications need to be evaluated for the Santa Cruz AMA.

5.6.2 Conservation Requirements for New Large Municipal Providers

A new large municipal provider is defined as a city, town, private water company, or irrigation district that begins serving more than 250 acre-feet of non-irrigation water per year after January 1, 2000. All new large municipal providers will initially be assigned to the Total GPCD Program. Their total GPCD requirement will be calculated consistent with the component methodology used for existing large municipal providers.

The base year for new large municipal providers will be the year or years preceding the first year the provider began serving more than 250 acre-feet unless the director determines that water use during that period is not representative. The Department will use residential water use data for the base year to conduct an analysis of conservation potential and calculate a GPCD component for existing residential users. New users will be assigned the new residential model rates of 57 GPCD interior and 107 GPHUD exterior for new single family development and 57 GPCD interior and 26 GPHUD exterior for new multifamily development. The non-residential component will be based on the actual non-residential water use rate in the service area (excluding turf facility water use) up to 21 GPCD. Lost and unaccounted for water may constitute up to 10 percent of the total annual water use.

A new large provider may apply for an administrative review requesting a temporary adjustment to its total GPCD requirement in order to serve a turf-related facility. A temporary adjustment will be allowed if the provider demonstrates that direct use effluent or effluent recovered within the area of impact is committed to serve the turf-related facility beginning in four years, but a longer period is necessary for sufficient effluent to be produced to serve the entire facility. The adjustment will remain in effect only until sufficient direct use effluent or effluent recovered within the area of impact is available to serve the entire facility, not to exceed eight years, and may be adjusted as the volume of effluent use increases. The adjustment will be terminated if the infrastructure necessary to deliver the effluent to the facility is not in place at the beginning of the fourth year after the provider commences service to the facility. A permanent adjustment will not be granted to a new large municipal provider. If a new large municipal provider cannot serve a turf-related facility under its existing per capita requirement and direct use effluent or effluent recovered within the area of impact will not be physically available to serve the facility within a reasonable period of time, the provider may enroll in the Non-Per Capita Conservation Program or the Alternative Conservation Program, if it wishes to serve the facility.

Each new large municipal provider will be notified of its total GPCD requirement and will be given two full years to comply with the requirement. A new large municipal provider may apply for the NPCCP or the ACP in accordance with the provisions of these programs and is subject to the individual user requirements.

5.6.3 <u>Conservation Requirements for Consolidated Providers and Providers that Acquire or Convey a Portion of a Service Area</u>

If two or more municipal providers consolidate their service areas and their combined water use is more than 250 acre-feet or if a large municipal provider acquires a portion of another provider's service area, the consolidated provider, acquiring provider, or conveying provider will receive a recalculated or revised conservation requirement. A consolidated provider will be assigned to the Total GPCD Program and its GPCD requirement will be calculated by prorating the respective per capita component rates, populations, and water use as appropriate. A consolidated provider may apply for the NPCCP or the ACP. If one of the consolidated providers was regulated under one of those programs prior to the consolidation, the consolidated provider's application for the program must include only the information that has changed since the provider filed its initial application. Providers that acquire or convey a portion of a service area continue to be regulated under the conservation program they were regulated under prior to the acquisition or conveyance. However, if they were regulated under either the NPCCP or the ACP, they must reapply for regulation under the program within 180 days after the acquisition or conveyance and must submit only the information that has changed since the original application was filed.

5.6.4 <u>Conservation Requirements for Small Municipal Providers</u>

A small municipal provider is a provider that serves 250 acre-feet or less of water for non-irrigation use during a year. Small municipal providers are exempt from per capita conservation requirements. Instead the director is required to establish "reasonable conservation requirements" for small municipal providers. In the Third Management Plan, as in the Second Management Plan, small municipal providers are required to minimize waste of all water supplies, maximize efficiency in outdoor watering, encourage reuse of water supplies, and reduce total GPCD water use.

5.6.5 <u>Regulatory Requirements for all Municipal Providers</u>

5.6.5.1 Individual User Requirements

An individual user is a person who receives water from a municipal provider for non-irrigation uses to which specific conservation requirements apply. For the Third Management Plan, the director is required to establish "such other conservation measures as may be appropriate for individual users." A.R.S. § 45-566(A)(2). In the Second Management Plan, individual user requirements were established for turf-related facilities, publicly owned rights-of-way, and new large-scale cooling facilities. These requirements have been retained for the Third Management Plan with some modifications.

Turf-related facilities are subject to an allotment-based requirement. Landscaping planted after December 31, 1986 in publicly owned rights-of-way and watered with water withdrawn from wells, other than stored water, must be planted with plants from the Low Water Use/Drought Tolerant Plant List (Appendix 5B). The large-scale cooling tower requirements have been modified from the Second Management Plan requirements which applied only to towers built after January 1, 1990 with a total capacity of 250 tons or more. The Third Management Plan regulates large-scale cooling facilities of all ages with a total capacity of 1,000 tons or more.

In addition to these individual user requirements, the Third Management Plan contains an individual user requirement that was not included in the Second Management Plan. Water withdrawn from wells, other than stored water, may not be used to maintain a water feature installed in a publicly owned rights-of-way after January 1, 2002.

Either the individual user or the municipal provider serving the individual user is responsible for complying with the individual user requirement. See section 5.2.3 for a discussion of how responsibility is determined.

5.6.5.2 Distribution System Requirements

All municipal providers are required to limit lost and unaccounted for water use in their service area. Lost and unaccounted for water includes line leakage, meter under-registration, evaporation or leakage from storage ponds or tanks, system and hydrant leaks or breaks, and illegal connections. Lost and unaccounted for water is defined as the total water from any source, except direct use effluent, withdrawn, diverted, or received in a year minus the total amount of authorized deliveries made by the municipal provider in that year. Small municipal providers must maintain lost and unaccounted for water volumes at no more than 15 percent. Large municipal providers are required to maintain systems not to exceed 10 percent lost and unaccounted for water.

Water that is put to a beneficial use and water system operation uses, whether metered or estimated, are not counted as lost or unaccounted for water. For the third management period, the Department will allow providers to either meter or estimate (using approved estimating procedures) the volume of water used pursuant to regulatory requirements such as well purging and line flushing. Providers may also estimate water for uses such as construction or fire services. However, all other water uses must be metered. This is especially important for large distribution systems which tend to have many hundreds of customers and many miles of distribution pipe. For a complete listing of uses that can be estimated, refer to Appendix 5J.

5.6.5.3 Monitoring and Reporting Requirements

All municipal providers are required to annually report to the Department the total volume of water used within the service area and the total volume of water delivered for various municipal purposes. In addition, the provider must calculate the volume of lost and unaccounted for water within the service area and report the total number of housing units, by unit type, added to the service area from July 1 of the previous calendar year to July 1 of the reporting year. Most municipal providers maintain a database and tracking system of this information for the previous 12 months. Maintaining this type of information allows municipal providers to identify difficulties in the operation of the distribution system and better meet water management objectives within their service areas.

Large municipal providers are required to separately measure and report the amount of water delivered each month for the following uses and categories: irrigation; residential, separated into single family and multifamily; and non-residential, separated into turf-related, commercial, industrial, government, construction, surface water treatment, and other uses.

All municipal providers are required to annually submit to the Department an updated service area and distribution system map that includes all potable and non-potable distribution lines greater than 4 inches, all potable treatment facilities, all well sites, all non-potable treatment facilities, and other information.

Large municipal providers regulated under the NPCCP or the ACP are required to submit a progress report that includes an evaluation of the results of implementing the RCMs in accordance with their written stipulated agreement.

5.7 INCENTIVES FOR THE USE OF RENEWABLE SUPPLIES AND REMEDIATED GROUNDWATER

Although they may have limited applicability in the Santa Cruz AMA incentives have been developed to increase the use of non-groundwater supplies. Effluent that is used directly or stored underground and recovered from within the area of impact is not counted in the per capita rate calculation for municipal providers regulated under the Total GPCD Program or the ACP.

In 1997, the Legislature enacted legislation significantly revising the Water Quality Assurance Revolving Fund (WQARF) Program to provide incentives for the use of remediated groundwater to facilitate the treatment of contaminated groundwater. Among other things, the WQARF legislation provides that when determining compliance with management plan conservation requirements, the Department shall account for groundwater withdrawn pursuant to approved remedial action projects under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, consistent with the accounting for surface water. Laws 1997, Ch. 287, § 51(B). See Chapter 7, section 7.4.4.6.3. Groundwater withdrawn pursuant to an approved remedial action project retains its legal character as groundwater for all other purposes under Title 45, Arizona Revised Statutes, including all other laws regulating groundwater withdrawal and use such as the assessment of withdrawal fees pursuant to A.R.S. § 45-611, *et seq.*; as well as laws regulating water exchanges as set forth in A.R.S. § 45-1001, *et seq.*; the transportation of groundwater as set forth in A.R.S. § 45-541, *et seq.*; withdrawals of groundwater for transportation to active management areas as set forth in A.R.S. § 45-551, *et seq.*; and underground water storage, savings, and replenishment as set forth in Title 45, Chapter 3.1, Arizona Revised Statutes.

For each approved remedial action project, the annual amount of groundwater that is eligible for the remediated groundwater accounting incentive is the maximum annual volume of groundwater that may be withdrawn pursuant to the project, as specified in the consent decree or other document approved by the EPA or ADEQ. However, if the project was approved prior to June 15, 1999 and the maximum annual volume of groundwater that may be withdrawn pursuant to the project is not specified in a consent decree or other document approved by the EPA or ADEQ, the annual amount of groundwater that is eligible for the remediated groundwater accounting incentive is the highest annual use of groundwater withdrawn pursuant to the project prior to January 1, 1999. The director may modify the annual amount of groundwater that is eligible for the accounting incentive if an increase in withdrawals is necessary to further the purpose of the project or if a change is made to the consent decree or other document approved by the EPA or ADEQ.

In order to qualify for the remediated groundwater accounting incentive, a person must notify the director in writing of the anticipated withdrawal of the groundwater prior to its withdrawal. The notification must include a copy of a document approved by ADEQ or the EPA such as the Remedial Action Plan (RAP), Record of Decision (ROD) or consent decree. Unless specified in the document, the notification must include the volume of groundwater that will be pumped annually pursuant to the project, the time period to which the document applies, and the annual authorized volume of groundwater that may be withdrawn pursuant to the project. The notification must also include the purpose for which the remediated groundwater will be used and the name and telephone number of a contact person. Additionally, at the time the notice is given, the person must be using remediated groundwater pursuant to the approved remedial action or must have agreed to do so through a consent decree or other document approved by ADEQ or the EPA. Remediated groundwater which qualifies for the accounting must be metered and reported separately from water withdrawn from wells that does not qualify for the accounting. (See section 5-114 of the municipal conservation requirements).

During the third management period, the Department will examine existing incentives and determine if additional water management based incentives can be developed and implemented for the Santa Cruz AMA.

5.8 NON-REGULATORY EFFORTS

In 1991, the Department initiated a grant program to provide funds for conservation assistance and augmentation of water supplies in the AMAs. Individual AMA programs focus on the areas of highest water conservation potential in each water use sector (municipal, industrial, and agricultural) based on total water usage, current water use practices, and potential for implementation of new conservation technologies. Funding for each AMA's grant program comes from an annual withdrawal fee levied and collected from all regulated water users in the AMAs. The Conservation Assistance Program is discussed in detail in Chapter 9, including a list of conservation programs funded during the second management period.

5.9 FUTURE DIRECTIONS

Modifications of the plan will result in better coordination with the AWS Rules consistency with goal criteria, when adopted for the Santa Cruz AMA. The ACP consistency with management goal criteria, specifically, will be more fully developed. In addition, the well spacing criteria included in this plan will be modified as additional hydrologic information is collected and analyzed and the hydrologic model for the AMA is completed.

The Department will also pursue legislation necessary to integrate the NPCCP into the goals of the Santa Cruz AMA. As the management strategies proposed in the concept paper are refined through public process, the groundwater use limitation requirement of the NPCCP would be modified to be consistent with the adopted regulations.

The Department will continue to work with the community to develop water management tools to assist the water users of the Santa Cruz AMA in maintaining safe-yield conditions and preventing long-term declines in local water table levels.

A remaining issue that needs to be addressed in the third management period is to design a conservation program approach for private water companies that meets both the ACC standards and the AMA water management goals. The Department will continue to work with the ACC in the development of policies related to water conservation and supply acquisition and on conditions for appropriate recovery of costs associated with the Department's regulatory programs.

There are ongoing issues about the effectiveness of water conservation programs. To the extent feasible, the Department will assist in designing follow-up studies and analyses to evaluate program effectiveness. This may be assisted through some funding from the Conservation Assistance Program for municipal research or evaluation projects. Throughout the third management period, the Department will work to improve water use data collection to support both planning and conservation program evaluation efforts. The Department will also continue to provide direct conservation assistance to water providers to assist them in meeting their regulatory requirements.

5.10 MUNICIPAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS

5-101. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in this chapter shall have the following meanings:

1. *"Canal" means a waterway constructed for the purpose of transporting water to a point of delivery, including main canals and lateral canals.*

2. *"Common area" means a recreational or open space area or areas owned and operated as a single integrated facility and maintained for the benefit of the residents of a housing development.*

3. *"Construction use" means a use of water for construction purposes, including the use of water for dust control, compaction, and preparation of building materials on construction sites.*

4. *"Direct use effluent" means effluent transported directly from a facility regulated pursuant to Title 49, Chapter 2, Arizona Revised Statutes, to an end user. Direct use effluent does not include effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes.*

5. *"Effluent recovered within the area of impact" means effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes, and recovered within the stored effluent's area of impact. For purposes of this definition, "area of impact" has the same meaning as prescribed by A.R.S. § 45-802.01.*

6. *"Existing individual user" means an individual user that was receiving water from a municipal provider as of the date the Third Management Plan was adopted.*

7. *"Existing large municipal provider" means a large municipal provider that was in operation and was serving water on or before January 1, 2000.*

8. *"Existing non-residential customer" means, with respect to a large municipal provider regulated under the NPCCP described in section 5-104 or the ACP described in section 5-105, a non-residential customer to whom the provider served water on the date the provider was accepted for regulation under the program.*

9. *"Existing residential customer" means, with respect to a large municipal provider regulated under the NPCCP described in section 5-104, a residential customer to whom the provider served water on the date the provider was accepted for regulation under the program.*

10. *"Existing residential housing units" means housing units which first began using water prior to July 1, 2000.*

11. *"Existing residential population" means the portion of the service area population of a municipal provider that resides in existing residential housing units.*

12. *"Exterior water use" means non-residential or residential uses of water for landscaping, pools, evaporative cooling systems, decorative fountains, and other outdoor uses of water.*

13. *"GPCD" means gallons of water per capita per day.*

14. *"GPHUD" means gallons of water per housing unit per day.*

15. *"Housing unit" means a group of rooms or a single room occupied as separate living quarters. Housing unit includes a single family home, a patio home, a townhouse, a condominium, an apartment, a permanently set-up mobile home, or a unit in a multifamily complex. Housing unit does not include a mobile home in an overnight or limited-stay mobile home park or a unit in a campground, motel, hotel, or other temporary lodging facility. A housing unit may be occupied by a family, a family and unrelated persons living together, two or more unrelated persons living together, or by one person.*

16. *"Incidental recharge" and "incidental recharge factor" have the definitions prescribed by A.R.S. § 45-561.*

17. *"Individual user" means a person receiving water from a municipal provider for non-irrigation uses to which specific conservation requirements apply, including turf-related facilities, large-scale cooling facilities, and publicly-owned rights-of-way.*

18. *"Interior water use" means non-residential or residential indoor uses of water, including toilet flushing, bathing, drinking, and washing.*

19. *"Landscapable area" means the entire area of a lot less any areas covered by structures, parking lots, roads, and any other area not physically capable of being landscaped.*

20. *"Large municipal provider" means a municipal provider serving more than 250 acre-feet of water for non-irrigation use during a calendar year.*

21. *"Large-scale cooling facility" means a facility which has control over cooling operations with a total combined cooling capacity greater than or equal to 1,000 tons. For the purposes of this definition, the minimum cooling tower size which shall be used to determine total facility cooling capacity is 250 tons. A large-scale cooling facility does not include a large-scale power plant that utilizes cooling towers to dissipate heat.*

22. *"Lost and unaccounted for water" means the total quantity of water from any source, except direct use effluent, withdrawn, diverted, or received by a municipal provider during a calendar year less the total quantity of authorized deliveries of water from any source, except direct use effluent, made by the municipal provider during the calendar year that are metered deliveries or deliveries that the municipal provider accounts for by a method of estimating water use approved by the director.*

23. *"Mined groundwater" has the definition prescribed by A.R.S. § 45-561.*

24. *"Multifamily housing unit" means a mobile home in a mobile home park and any permanent housing unit having one or more common walls with another housing unit located in a multifamily residential structure and includes a unit in a duplex, triplex, fourplex, condominium development, town home development, or apartment complex.*

25. *"Municipal distribution system" means a system of pipes, canals, or other works within a municipal provider's service area which are owned and operated by the provider to collect, store, treat, or deliver water for non-irrigation use.*

26. *"Municipal provider" means a city, town, private water company, or irrigation district that supplies water for non-irrigation use.*

27. *"New individual user" means an individual user that begins receiving water from a municipal provider after adoption of the Third Management Plan.*

28. *"New large provider" means a municipal provider that begins serving more than 250 acre-feet of water for non-irrigation use during a calendar year after January 1, 2000.*

29. *"New multifamily housing units" means multifamily housing units which first begin using water on or after July 1, 2000.*

30. *"New multifamily population" means the portion of the service area population of a municipal provider that resides in new multifamily housing units.*

31. *"New non-residential customer" means, with respect to a large municipal provider regulated under the NPCCP described in section 5-104 or the ACP described in section 5-105, a non-residential customer that begins receiving water from the provider after the provider is accepted for regulation under the program.*

32. *"New residential customer" means, with respect to a large municipal provider regulated under the NPCCP described in section 5-104, a residential customer that begins receiving water from the provider after the provider is accepted for regulation under the program.*

33. *"New single family housing units" means single family housing units which first begin using water on or after July 1, 2000.*

34. *"New single family population" means the portion of the service area population of a municipal provider that resides in new single family housing units.*

35. *"Non-residential customer" means a person who is supplied water by a municipal provider for a non-irrigation use other than a residential use.*

36. *"Non-residential exterior water use" means, with respect to a large municipal provider regulated under the NPCCP described in section 5-104 or the ACP described in section 5-105, water supplied by the provider and used for exterior water use purposes by non-residential customers, other than individual users, within the provider's service area.*

37. *"Non-residential interior water use" means, with respect to a large municipal provider regulated under the NPCCP described in section 5-104 or the ACP described in section 5-105, water supplied by the provider and used for interior water use purposes by non-residential customers, other than individual users, within the provider's service area.*

38. *"Reasonable Conservation Measures" or "RCMs" means policies, practices, rules, regulations, ordinances, or the use of devices, equipment, or facilities, that meet either of the following criteria:*

a. An established and generally accepted practice among water providers that results in efficient use or conservation of water; or

b. A practice for which sufficient data are available from existing water conservation projects to indicate that significant water conservation or conservation related benefits can be achieved, that the practice is technically and economically reasonable and not environmentally or socially unacceptable, and that the practice is not otherwise unreasonable for most water providers to implement.

39. "Residential customer" means a person who is supplied water by a municipal provider for a residential use.

40. "Residential exterior water use" means, with respect to a large municipal provider regulated under the NPCCP described in section 5-104, water supplied by the provider and used for exterior water use purposes by residential customers within the provider's service area.

41. "Residential interior water use" means, with respect to a large municipal provider regulated under the NPCCP described in section 5-104, water supplied by the provider and used for interior water use purposes by residential customers within the provider's service area.

42. "Residential use" means a non-irrigation use of water related to the activities of a single family or multifamily housing unit or units, including exterior water use.

43. "Service area" has the definition prescribed by A.R.S. § 45-402.

44. "Service area population" means the number of people residing in housing units connected to distribution lines maintained by the municipal provider within its service area which are being served as of July 1 of the applicable year, as determined pursuant to section 5-103, subsection D.

45. "Service connection" means a coupling of a municipal provider's distribution system and its customer's water system.

46. "Single family housing unit" means a detached dwelling, including mobile homes not in mobile home parks.

47. "Small municipal provider" means a municipal provider that supplies 250 acre-feet or less of water for non-irrigation use during a calendar year.

48. "Turf-related facility" means any facility, including cemeteries, golf courses, parks, schools or common areas within housing developments, with a water-intensive landscaped area of 10 or more acres. Turf-related facilities include, but are not limited to, those facilities listed in Appendix 6.

49. "Water-intensive landscaped area" means, for a calendar year, an area of land which is watered with a permanent water application system and planted primarily with plants not listed in Appendix 5B (Low Water Use/Drought Tolerant Plant List), and any modifications to the list, and the total surface area of all bodies of water filled or refilled with water from any source, including effluent, that are an integral part of the landscaped *area. Bodies of water used primarily for swimming purposes are not an integral part of a landscaped area.*

5-102. Large Municipal Providers - Conservation Programs

A. *Beginning with the calendar year determined under Section 5-103, subsection A, paragraph 2, and continuing until the first compliance date for any substitute requirement in the Fourth Management Plan, a large municipal provider shall be regulated under the Total GPCD Program described in section 5-103, unless the provider has applied for and been accepted for regulation under the NPCCP described in section 5-104 or the ACP described in section 5-105 or is designated as an institutional provider under section 5-107.*

If a large municipal provider is accepted into the NPCCP, the ACP, or is designated as an institutional provider, the provider shall continue to comply with its total GPCD requirement until the first compliance date assigned by the director for the provider under the ACP, the NPCCP, or as an institutional provider.

A large municipal provider that was regulated under the NPCCP, the ACP, or the IPP under the Second Management Plan and that applies to be regulated under the same program in the Third Management Plan within 180 days following adoption of the plan shall continue to be regulated under the NPCCP, the ACP, or the IPP under the Second Management Plan, whichever applies, until January 1, 2002 or until the director approves or denies the provider's application under the Third Management Plan, whichever is later.

B. *A large municipal provider may apply for the NPCCP as described in section 5-104. If the director approves the application, the provider shall comply with the requirements of the NPCCP beginning on a date determined by the director but not later than January 1 of the year following the year in which the application is approved.*

C. *A large municipal provider may apply for the ACP as described in section 5-105. If the director approves the application, the provider shall comply with the requirements of the ACP beginning on a date determined by the director but not later than January 1 of the year following the year in which the application is approved.*

D. *A large municipal provider may apply for designation as an institutional provider pursuant to section 5-107. If the director approves the application, the provider shall comply with the institutional provider requirements assigned by the director beginning on a date determined by the director but not later than January 1 of the year following the year in which the application is approved.*

E. *All municipal providers shall comply with individual user requirements, distribution system requirements, and applicable monitoring and reporting requirements as prescribed in sections 5-111, 5-112, and 5-113.*

5-103. Large Municipal Provider Total Gallons Per Capita Per Day Program

A. Total GPCD Requirement

1. Beginning with the calendar year determined under paragraph 2 of this subsection, and for each calendar year thereafter until the first compliance date for any substitute municipal conservation requirement in the Fourth Management Plan, a large municipal provider regulated under the Total GPCD Program shall not withdraw, divert, or receive *water from any source, except direct use effluent and effluent recovered within the area of impact, for non-irrigation use during a year in a total amount that exceeds its total GPCD requirement for the year as calculated in subsection B of this section, except as provided in the flexibility account provisions in section 5-106.*

2. *A large municipal provider regulated under the Total GPCD Program shall begin complying with its total GPCD requirements under the Third Management Plan beginning with calendar year 2000, except that if the provider's total GPCD requirement for the year 2000 under the Third Management Plan is lower than the provider's final total GPCD requirement under the Second Management Plan, the provider shall begin complying with its total GPCD requirements under the Third Management Plan beginning with calendar year 2002.*

B. Calculation of the Annual Total GPCD Requirement

A large municipal provider's total GPCD requirement for a year shall be calculated as follows:

1. *For each calendar year 2000 through 2004, multiply the provider's existing residential population for the year, as calculated pursuant to subsection D of this section, by the first intermediate GPCD component for existing residential population as assigned to the provider in Table 5-5.*

   For calendar years 2005 through 2009, multiply the provider's existing residential population for the year, as calculated pursuant to subsection D of this section, by the second intermediate GPCD component for existing residential population as assigned to the provider in Table 5-5.

   For the calendar year 2010, and for each calendar year thereafter until the first compliance date for any substitute total GPCD requirement in the Fourth Management Plan, multiply the provider's existing residential population for the year, as calculated pursuant to subsection D of this section, by the final GPCD component for existing residential population as assigned to the provider in Table 5-5.

2. *Multiply the provider's new single family population for the year, as calculated pursuant to subsection D of this section, by 57 GPCD.*

3. *Multiply the number of new single family housing units within the provider's service area as of July 1 of the calendar year in question by 107 GPHUD.*

4. *Multiply the provider's new multifamily population for the year, as calculated pursuant to subsection D of this section, by 57 GPCD.*

5. *Multiply the number of new multifamily housing units within the provider's service area as of July 1 of the calendar year in question by 26 GPHUD.*

6. *Multiply the provider's total service area population for the year, as calculated pursuant to subsection D of this section, by the GPCD component for non-residential use as assigned to the provider in Table 5-5.*

7. *Determine the provider's allocation for turf-related facilities for the year as follows:*

a. *Add together the maximum annual water allotments in Appendix 5G, in acre-feet, for those turf-related facilities assigned to the provider in Appendix 5G to which the provider served water from any source during the year. For any year in which the provider served water from any source to all of the turf-related facilities assigned to the provider in Appendix 5G, the sum of the allotments is shown in Table 5-5. The sum is the provider's turf-related facility component for the year.*

TABLE 5-5
EXISTING RESIDENTIAL, NON-RESIDENTIAL, AND TURF-RELATED FACILITY COMPONENTS*
SANTA CRUZ ACTIVE MANAGEMENT AREA

Provider	***Existing Residential (GPCD)***			***Non-Residential[1] (GPCD)***	***Turf-related Facility[2] (AF/year)***
	TMP 1	***TMP 2***	***TMP Final***		
Citizens Utilities - Tubac	*173*	*167*	*161*	*34*	*N/A*
City of Nogales	*100*	*98*	*97*	*46*	*860*
Rio Rico Utilities	*113*	*110*	*108*	*39*	*N/A*
Valle Verde Water Company	*76*	*74*	*73*	*11*	*N/A*

TMP = Third Management Plan
AF = acre-feet
[1] *Providers with a non-residential component less than 21 GPCD may increase their non-residential component up to 21 GPCD.*
[2] *The number shown in this column is the sum of the maximum annual water allotments for all turf-related facilities assigned to the provider in Appendix 5G. In any year in which the provider serves water from any source to some, but not all, of the turf-related facilities assigned to the provider in Appendix 5G, the provider's turf-related facilities component for the year is the sum of the maximum annual water allotments shown in Appendix 5G for the turf-related facilities listed in that appendix to which the provider served water during the year.*
* *An example explaining how the Total GPCD Requirement is calculated is included in Appendices 5C.1 and 5C.2.*

b. *Multiply the component from subparagraph a of this paragraph by 325,851 gallons and then divide the product by the number of days in the year.*

8. *Divide the provider's allowable lost and unaccounted for water by the number of days in the calendar year. The provider's allowable lost and unaccounted for water is the lesser of the following:*

   a. *the provider's actual lost and unaccounted for water for the year, in gallons.*

   b. *an amount calculated by multiplying the total gallons of water from any source, except direct use effluent, withdrawn, diverted, or received by the provider during the year by 10 percent.*

9. *Add the results from paragraphs 1 through 7 of this subsection and then divide the sum by the provider's annual service area population as of July 1 of that year. The quotient is the provider's total GPCD requirement for the calendar year.* ***See Appendices 5C.1 and 5C.2 for an example of this calculation.***

C. Compliance with Total GPCD Requirement

The director shall determine if a large municipal provider is in compliance with its total GPCD requirement for a calendar year pursuant to the flexibility account provisions in *section 5-106, using the provider's service area population as calculated in subsection D of this section.*

D. Calculation of Large Municipal Provider's Service Area Population

The director shall calculate a large municipal provider's service area population for a calendar year as follows, unless the director has approved an alternative methodology for calculating the provider's service area population prior to the calendar year in question:

1. *Determine the number of existing single family housing units and existing multifamily housing units served by the provider's distribution system as of July 1, 2000 less any existing single family housing units and any existing multifamily housing units removed from the provider's distribution system between July 1, 2000 and June 30 of the calendar year in question.*

2. *Adjust these totals by the respective average annual vacancy rate for single family housing units and multifamily housing units as calculated from the most recent census or other approved source of information.*

3. *Multiply the adjusted number of existing single family housing units calculated in paragraph 2 of this subsection by the average number of persons per occupied single family housing unit as calculated in accordance with the most recent census or other approved source of information.*

4. *Multiply the adjusted number of existing multifamily housing units calculated in paragraph 2 of this subsection by the average number of persons per occupied multifamily housing unit as calculated in accordance with the most recent census or other approved source of information.*

5. *Add the products from paragraphs 3 and 4 of this subsection. The sum is the provider's existing residential population.*

6. *Determine the number of new single family housing units and new multifamily housing units added to the provider's distribution system between July 1 of the previous calendar year and July 1 of the calendar year in question, less any new single family and new multifamily housing units removed from the system during that period.*

7. *Adjust these totals by the respective average annual vacancy rate for single family housing units and multifamily housing units as calculated from the most recent census or other approved source of information.*

8. *Multiply the adjusted number of new single family housing units calculated in paragraph 7 of this subsection by the average number of persons per occupied single family housing unit as calculated in accordance with the most recent census or other approved source of information.*

9. *Multiply the adjusted number of new multifamily housing units calculated in paragraph 7 of this subsection by the average number of persons per occupied multifamily housing unit as calculated in accordance with the most recent census or other approved source of information.*

10. *Add the product from paragraph 8 to the provider's new single family population as of July 1 of the previous year and add the product from paragraph 9 to the provider's new multifamily population as of July 1 of the previous year. The sums are the provider's new single family population and new multifamily population.*

11. *Add the results from paragraphs 5 and 10. The sum is the provider's service area population for the calendar year.*

5-104. Non-Per Capita Conservation Program

A. Eligibility for the Non-Per Capita Conservation Program

A large municipal provider may apply for the NPCCP if any of the following applies:

1. *The provider is a member of a groundwater replenishment district established under Title 48, Chapter 27, Arizona Revised Statutes.*

2. *The service area of the provider has qualified as a member service area under Title 48, Chapter 22, Arizona Revised Statutes, or as a water district member under Title 48, Chapter 28, Arizona Revised Statutes, and the conditions established under A.R.S. § 45-576.01(B)(2) and (3) are met by the conservation district or the water district, as applicable, for the AMA in which the service area is located.*

3. *The provider has developed a plan to both:*

   a. *Reduce the proportion of mined groundwater supplied by it for use within its service area such that the result computed by dividing the volume of mined groundwater supplied by the provider for use within its service area in a year by the volume of all water supplied by the provider for use within its service area in that year does not exceed:*

      1) *Two-thirds for 2000.*
      2) *Three-fifths for 2001.*
      3) *Eight-fifteenths for 2002.*
      4) *Seven-fifteenths for 2003.*
      5) *Two-fifths for 2004.*
      6) *One-third for 2005.*
      7) *Four-fifteenths for 2006.*
      8) *One-fifth for 2007.*
      9) *Two-fifteenths for 2008.*
      10) *One-fifteenth for 2009.*

   b. *Deliver no mined groundwater for use within its service area after January 1, 2010.*

4. *The provider is designated as having an assured water supply under rules adopted by the director pursuant to A.R.S. § 45-576.*

B. Application for Non-Per Capita Conservation Program

A large municipal provider's application for the NPCCP must be approved by the provider's governing body and must include the following:

1. *A description and evaluation, including implementation dates, of the provider's existing conservation programs.*

2. *A description of conservation programs the provider intends to implement if approved for the NPCCP, including a time schedule for implementing the programs.*

3. *If the provider is applying for the NPCCP under subsection A, paragraph 3, a water supply plan demonstrating that the provider will reduce the proportion of mined groundwater supplied by it within its service area to the proportions described in that subparagraph and that it will deliver no mined groundwater after January 1, 2010.*

4. *If the provider intends to comply with subsection D of this section by implementing one or more substitute RCMs in lieu of a standard RCM or if the provider requests the director to modify a level of conservation potential for the provider's service area pursuant to subsection D, paragraph 1, subparagraph a of this section, an analysis of water use within the provider's service area which includes all of the following:*

   a. *If the provider intends to implement one or more substitute RCMs, information demonstrating that the substitute RCM or RCMs will be designed to achieve a water use efficiency within the provider's service area equivalent to the efficiency that would result from implementation of the standard RCM or RCMs.*

   b. *The amount of water used each month during the past three years by each of the following water use sectors, as applicable: (1) residential (disaggregated by single family and multifamily), (2) commercial, (3) industrial, (4) turf-related facilities, (5) government, (6) construction, (7) distribution system losses, and (8) any other uses. The provider is not required to include this information if it has already been reported to the Department.*

   c. *An identification and evaluation of the water use sectors described in paragraph b of this subparagraph that have the highest water conservation potential.*

5. *If the provider is requesting an individual incidental recharge factor under subsection C, paragraph 2 of this section:*

   a. *A copy of a hydrological study which demonstrates the amount of water withdrawn, diverted, or received for delivery by the provider for use within its service area during each of the preceding five years and the amount of incidental recharge that was attributable to the provider during those years. The study shall be prepared consistent with the methodology contained in Appendix 5K.*

   b. *A copy of a hydrological study projecting the average annual amount of water that will be withdrawn, diverted, or received for delivery by the provider for use within its service area during the management period and the average annual amount of incidental recharge that will be attributable to the provider during the management period.*

6. *Any other information required by the director.*

C. Incidental Recharge Factor

1. Standard Incidental Recharge Factor

The standard incidental recharge factor for the Santa Cruz AMA for the third management period is 0 percent. The standard incidental recharge factor shall be used to calculate the amount of mined groundwater supplied during a year by a large municipal provider that applied for the NPCCP under subsection A, paragraph 3 of this section, unless the provider applies for and is granted an individual incidental recharge factor pursuant to paragraph 2 of this subsection.

2. Individual Incidental Recharge Factor

A large municipal provider that applies for the NPCCP under subsection A, paragraph 3 of this section, may request an incidental recharge factor that is different than the standard incidental recharge factor set forth in paragraph 1 of this subsection by submitting the information described in subsection B, paragraph 5 of this section, with its application. The director shall establish a different incidental recharge factor for the provider as described in Appendix 5K if the information submitted by the provider demonstrates that the ratio of the average annual amount of incidental recharge expected to occur within the provider's service area during the third management period to the average annual amount of water expected to be supplied by the provider for use within its service area during the third management period is different than the standard incidental recharge factor. If the director establishes an individual incidental recharge factor for the provider under this paragraph, the individual incidental recharge factor shall be used to calculate the amount of mined groundwater supplied by the provider during a year.

D. Criteria for Approval of Application

A large municipal provider that applies for the NPCCP shall be approved for the program only if all of the following conditions are satisfied, as applicable:

1. The provider agrees in writing to implement RCMs that the director determines will, if properly implemented, result in the achievement of a water use efficiency within the provider's service area equivalent to the water use efficiency assumed in the provider's total GPCD requirements for the third management period. To comply with this requirement, the provider must agree in writing to implement the following RCMs for the following water use categories and programs beginning on a date agreed upon by the director and the provider:

a. Residential Water Use

1) <u>Residential interior water use category</u> - The provider shall agree in writing to implement the residential interior standard RCMs described in Appendix 5H.1. In lieu of implementing one or both of the standard RCMs, the provider may agree to implement one or more of the residential interior substitute RCMs or system-related substitute RCMs listed in the substitute RCM list described in Appendix 5H.4 if the director determines that the substitute RCM or RCMs will be designed to achieve a water use efficiency within the provider's service area equivalent to the efficiency that would result from implementation of the standard RCM.

2) *<u>Residential exterior water use category</u> - The provider shall agree in writing to implement the residential exterior standard RCMs described in Appendix 5H.1. In lieu of implementing one or more of the standard RCMs, the provider may agree to implement one or more of the residential exterior substitute RCMs or system-related substitute RCMs listed in the substitute RCM list described in Appendix 5H.4 if the director determines that the substitute RCM or RCMs will be designed to achieve a water use efficiency within the provider's service area equivalent to the efficiency that would result from implementation of the standard RCM.*

3) *<u>Implementation level</u> - The provider shall agree to implement residential interior or exterior RCMs for existing residential customers at the implementation level (minimum, moderate, or maximum) that corresponds to the level of conservation potential that the director determined existed for interior and exterior water use by existing residential users within the provider's service area when the director established the provider's total GPCD requirements for the third management period, as shown in Appendix 5L.*

   The director may modify a level of conservation potential shown for a provider in Appendix 5L if the provider requests a modification in an application for administrative review pursuant to A.R.S. § 45-575(A) or in the provider's application for regulation under the NPCCP, and the provider demonstrates that the level of conservation potential shown in Appendix 5L is not accurate for the provider's service area. A provider requesting a modification of a level of conservation potential shall submit to the director a water use analysis containing the information described in subsection B, paragraph 4 of this section. If the level of conservation potential for interior or exterior water use by existing residential users as shown in Appendix 5L or as modified by the director is "no reduction," the provider is not required to implement any RCMs for existing residential customers in that water use category.

b. *Non-Residential Water Use*

1) *<u>Non-residential interior water use category</u> - The provider shall agree in writing to implement the non-residential interior standard RCMs described in Appendix 5H.2. In lieu of implementing one or more of the standard RCMs, the provider may agree to implement one or more of the non-residential interior substitute RCMs or system-related RCMs listed in the substitute RCM list described in Appendix 5H.4 if the director determines that the substitute RCM or RCMs will be designed to achieve a water use efficiency within the provider's service area equivalent to the efficiency that would result from implementation of the standard RCM.*

2) *<u>Non-residential exterior water use category</u> - The provider shall agree in writing to implement the non-residential exterior standard RCMs described in Appendix 5H.2. In lieu of implementing one or both of the standard RCMs, the provider may agree to implement one or more of the non-residential exterior substitute RCMs or system-related RCMs listed in the substitute RCM list described in Appendix 5H.4 if the director determines that the substitute RCM or RCMs will be designed to achieve a water use efficiency within the provider's service area equivalent to the efficiency that would result from implementation of the standard RCM.*

c. *Public Education Program*

The provider shall agree in writing to implement the education standard RCM described in Appendix 5H.3. In lieu of implementing the standard RCM, the provider may agree to implement one or more of the education substitute RCMs listed in the substitute RCM list described in Appendix 5H.4. The substituted RCM or RCMs must not duplicate other RCMs that the provider will implement as part of the NPCCP.

2. *If the provider is applying for the NPCCP under subsection A, paragraph 1 of this section, the provider will be accepted into the program only if the conditions established in A.R.S. § 45-576.01(A)(2) and (3) are met by the groundwater replenishment district of which the provider is a member.*

3. *If the provider is applying for the NPCCP under subsection A, paragraph 2 of this section, the provider will be accepted into the program only if the conditions established in A.R.S. § 45-576.01(B)(2) and (3) are met for the AMA by the multi-county water conservation district or AMA water district of which the provider is a member.*

4. *If the provider is applying for the NPCCP under subsection A, paragraph 3 of this section, the provider will be accepted into the program only if the director has determined that the provider will reduce the proportion of mined groundwater supplied within its service area to the proportions described in that subparagraph.*

5. *If the provider is applying for the NPCCP under subsection A, paragraph 4 of this section, the provider will be accepted into the program only if the director determines that the provider is designated as having an assured water supply under the rules adopted by the director under A.R.S. § 45-576.*

E. Non-Per Capita Conservation Program Requirements

A large municipal provider regulated under the NPCCP shall comply with the following requirements, as applicable, until the effective date of any substitute conservation requirements established in the Fourth Management Plan:

1. *The provider shall implement the RCMs agreed to in writing under subsection D, paragraph 1 of this section, beginning on a date agreed upon by the director and the provider.*

2. *If the provider applied for the NPCCP under subsection A, paragraph 3 of this section, the provider shall reduce the proportion of mined groundwater supplied within its service area to the proportions described in that paragraph. A provider's failure to comply with this requirement during any year will be excused if the provider demonstrates to the director's satisfaction that the failure was due to drought conditions or the failure of a surface water distribution system.*

3. *If the provider applied for the NPCCP under subsection A, paragraph 4 of this section, the provider shall not supply groundwater for use within its service area in an amount that exceeds the amount of groundwater that the provider may supply for use within its service area consistent with the rules adopted by the director pursuant to A.R.S. § 45-576. If the provider's Designation of AWS is revoked or otherwise terminates after the provider is accepted into the program, the amount of groundwater the provider may supply for use within its service area consistent with the rules shall be determined by the director as the*

amount of groundwater the provider would have been allowed to supply under the rules if the provider's Designation of AWS had not been revoked or terminated.

5-105. Alternative Conservation Program

A. Eligibility for the Alternative Conservation Program

A large municipal provider is eligible to apply for the ACP if one of the following applies:

1. *The provider is designated as having an assured water supply under rules adopted by the director pursuant to A.R.S. § 45-576.*

2. *The provider agrees that it will not withdraw or use water, other than stored water, from a well unless the withdrawal or use would be allowed under the consistency with management goal provisions of the Assured Water Supply Rules adopted by the director under A.R.S. § 45-576 as if the provider was designated as having an assured water supply under those rules.*

B. Application for Alternative Conservation Program

A large municipal provider's application for the ACP must be approved by the provider's governing body and must include the following:

1. *A demonstration of consistency with the Santa Cruz AMA management goal as required by subsection C, paragraph 1 of this section.*

2. *A description and evaluation, including implementation dates, of the provider's existing conservation programs.*

3. *A description of the proposed conservation strategies for all existing and new non-residential customers to be implemented by the provider under this program and the provider's schedule for implementation of all proposed conservation measures.*

4. *If the provider intends to comply with subsection C, paragraph 3 of this section, by implementing one or more substitute non-residential RCMs in lieu of a standard non-residential RCM, an analysis of water use within the provider's service area which includes all of the following:*

   a. *A demonstration that the substituted RCM or RCMs will be designed to achieve a water use efficiency within the provider's service area equivalent to the efficiency that would result from implementation of the standard RCM.*

   b. *The amount of water used each month during the past three years by each of the following water use sectors, as applicable: (1) residential (disaggregated by single family and multifamily), (2) commercial, (3) industrial, (4) turf-related facilities, (5) government, (6) construction, (7) distribution system losses, and (8) any other uses. The provider is not required to include this information if it has already been reported to the Department.*

   c. *An identification and evaluation of the water use sectors described in subparagraph b of this paragraph that have the highest water conservation potential.*

C. Alternative Conservation Program Requirements

1. Consistency With AMA Management Goal Requirement

a. Beginning with a calendar year agreed upon by the director and a large municipal provider regulated under the Alternative Conservation Program, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Fourth Management Plan, the provider shall not withdraw or use water, other than stored water, from a well unless the withdrawal or use complies with the following, as applicable:

1) If the provider is designated as having an assured water supply under the rules adopted by the director pursuant to A.R.S. § 45-576, the withdrawal or use would be allowed under the consistency with management goal provisions of Rule R12-15-705, Arizona Administrative Code.

2) If the provider is not designated as having an assured water supply under the rules adopted by the director pursuant to A.R.S. § 45-576, the withdrawal or use would be allowed under the consistency with management goal provisions of Rule R12-15-705, Arizona Administrative Code, as if the provider was designated as having an assured water supply under the rules.

b. Compliance

The director shall determine whether a large municipal provider is in compliance with its consistency with AMA management goal requirements, as described in subparagraph a, item 2 of this paragraph in a calendar year in the same manner as if the provider were designated as having an assured water supply.

2. Residential GPCD Requirement

a. Beginning with a calendar year agreed upon by the director and a large municipal provider regulated under the ACP and for each calendar year thereafter until the first compliance date for any substitute requirement in the Fourth Management Plan, the provider shall not serve water from any source, except direct use effluent and effluent recovered within the area of impact, for residential use during a calendar year in a total amount that exceeds its residential GPCD requirement for the year, except as provided in the flexibility account provisions in section 5-106. Each year the annual residential GPCD requirement for a provider regulated under the ACP shall be calculated as follows:

1) For each calendar year through 2004, multiply the provider's existing residential population for the year, as calculated pursuant to section 5-103, subsection D, by the first intermediate GPCD component for existing residential population as assigned to the provider in Table 5-5.

For calendar years 2005 through 2009, multiply the provider's existing residential population for the year, as calculated pursuant to section 5-103, subsection D, by the second intermediate GPCD component for existing residential population as assigned to the provider in Table 5-5.

For the calendar year 2010 and for each calendar year thereafter until the first compliance date for any substitute GPCD requirement in the Fourth Management Plan, multiply the provider's existing residential population for the year, as calculated pursuant to section 5-103, subsection D, by the final GPCD component for existing residential population as assigned to the provider in Table 5-5.

2) *Multiply the provider's new single family population for the year, as calculated pursuant to section 5-103, subsection D, by 57 GPCD.*

3) *Multiply the number of new single family housing units within the provider's service area as of July 1 of the calendar year in question by 107 GPHUD.*

4) *Multiply the provider's new multifamily population for the year, as calculated pursuant to section 5-103, subsection D, by 57 GPCD.*

5) *Multiply the number of new multifamily housing units within the provider's service area as of July 1 of the calendar year in question by 26 GPHUD.*

6) *Add the products from items 1 through 4 of this subparagraph and then divide the sum by the provider's service area population as of July 1 of the calendar year. The quotient is the provider's residential GPCD requirement for the calendar year.*

b. *Compliance with Residential GPCD Requirement*

The director shall determine if a large municipal provider regulated under the ACP is in compliance with its residential GPCD requirement pursuant to the flexibility account provisions in section 5-106.

3. *Non-Residential Requirement*

a. *A large municipal provider regulated under the ACP shall agree in writing to implement the following non-residential RCMs beginning on a date agreed upon by the director and the provider:*

1) *<u>Non-Residential Interior Requirements</u> - The provider shall agree in writing to implement the non-residential interior standard RCMs described in Appendix 5H.2. In lieu of implementing one or more of the standard RCMs, the provider may agree to implement one or more of the non-residential interior substitute RCMs or system-related RCMs listed in the substitute RCM list described in Appendix 5H.4 if the director determines that the substitute RCM or RCMs will be designed to achieve a water use efficiency within the provider's service area equivalent to the efficiency that would result from implementation of the standard RCM.*

2) *<u>Non-Residential Exterior Requirements</u> - The provider shall agree in writing to implement the non-residential exterior standard RCMs described in Appendix 5H.2. In lieu of implementing one or both of the standard RCMs, the provider may agree to implement one or more of the non-residential exterior substitute RCMs or system-related RCMs listed in the substitute RCM list described in Appendix 5H.4 if the director determines that the substitute RCM or RCMs will*

be designed to achieve a water use efficiency within the provider's service area equivalent to the efficiency that would result from implementation of the standard RCM.

5-106. Compliance with Total GPCD Requirement and Residential GPCD Requirement - Flexibility Account

A. Total GPCD Program Flexibility Account

The director shall determine if a large municipal provider regulated under the Total GPCD Program is in compliance with its annual total GPCD requirement through the maintenance of a flexibility account for the provider which shall operate as follows:

1. *Each provider regulated under the Total GPCD Program shall be assigned a flexibility account. The beginning balance in the flexibility account of a provider that was regulated under the Total GPCD Program in the Second Management Plan shall be the ending balance in the flexibility account maintained for the provider under section 5-105 of the Second Management Plan. The beginning balance in the flexibility account of all other large municipal providers shall be zero.*

2. *Following each calendar year in which the provider withdraws or receives water, other than stored water, from wells for non-irrigation use, beginning with the calendar year determined under section 5-103, subsection A, paragraph 2 or the calendar year in which the provider first becomes a large municipal provider, whichever is later, the director shall adjust the provider's flexibility account as follows:*

    a. *Determine the total gallons of water from any source, except direct use effluent and effluent recovered inside the area of impact, withdrawn, diverted, or received by the provider during the calendar year for non-irrigation use, and then subtract that amount from the amount of water the provider could legally withdraw, divert, or receive during the calendar year for non-irrigation use, as calculated in subparagraph d of this paragraph.*

    b. *If the result in subparagraph a above is negative, debit the flexibility account by this volume.*

    c. *If the result in subparagraph a above is positive, credit the flexibility account by this volume.*

    d. *The amount of water which a provider regulated under the Total GPCD Program can legally withdraw, divert, or receive for non-irrigation use during a calendar year is calculated by multiplying the provider's total GPCD requirement for the calendar year, as calculated pursuant to section 5-103, subsection B, by the provider's service area population as of July 1 of the year, as calculated pursuant to section 5-103, subsection D, and then multiplying the product by the number of days in the calendar year.*

3. *The account balance existing in a provider's flexibility account after the adjustment provided for in paragraph 2 of this subsection is made shall carry forward subject to the following limitations:*

a. The maximum positive account balance allowed in the flexibility account of a provider regulated under the Total GPCD Program shall be calculated by multiplying the provider's service area population as of July 1 of the calendar year by a GPCD rate of 30 and then multiplying that product by the number of days in the calendar year. If the account balance exceeds the maximum positive account balance after any credits are registered, the balance carried forward shall equal the maximum positive account balance allowed in the provider's flexibility account for that year.

b. The maximum negative account balance allowed in the flexibility account of a provider regulated under the Total GPCD Program shall be calculated by multiplying the provider's service area population as of July 1 of the calendar by a GPCD rate of -10 and then multiplying that product by the number of days in the calendar year. If the account balance exceeds the maximum negative account balance after any debits are registered, the balance carried forward shall equal the maximum negative account balance allowed in the provider's flexibility account for that year.

B. Alternative Conservation Program Flexibility Account

The director shall determine if a large municipal provider regulated under the ACP is in compliance with its annual residential GPCD requirement through the maintenance of a flexibility account for the provider which shall operate as follows:

1. Each provider regulated under the ACP shall be assigned a flexibility account with a beginning balance to be calculated by the director based on the ending balance in the provider's flexibility account while the provider was regulated under the Total GPCD Program or under the ACP of the Second Management Plan, whichever applies.

2. Following each calendar year in which the provider delivers water, other than stored water, withdrawn from wells for residential use, beginning with the calendar year agreed upon by the director and the provider, the director shall adjust the provider's flexibility account balance as follows:

a. Determine the total gallons of water from any source, except direct use effluent and effluent recovered within the area of impact, served by the provider during the calendar year for residential use, and then subtract that amount from the amount of water the provider could legally serve during the calendar year for residential use, as calculated in subparagraph d of this paragraph.

b. If the result in paragraph a above is negative, debit the flexibility account by this volume.

c. If the result in paragraph a above is positive, credit the flexibility account by this volume.

d. The amount of water which a provider regulated under the ACP can legally serve for residential use during a calendar year is calculated by multiplying the provider's residential GPCD requirement for the calendar year, as calculated pursuant to section 5-105, subsection C, paragraph 2, by the provider's service area population as of July 1 of the year as calculated pursuant to section 5-103, subsection D, and then multiplying the product by the number of days in the calendar year.

3. *The account balance existing in a provider's flexibility account after the adjustment provided for in paragraph 2 of this subsection is made shall carry forward subject to the following limitations:*

   a. *The maximum positive account balance allowed in the flexibility account of a provider regulated under the ACP shall be calculated by multiplying the provider's service area population as of July 1 of the calendar year by a GPCD rate of 21 and then multiplying that product by the number of days in the calendar year. If the account balance exceeds the maximum positive account balance after any credits are registered, the balance carried forward shall equal the maximum positive account balance allowed in the provider's flexibility account for that year.*

   b. *The maximum negative account balance allowed in the flexibility account of a ~~large~~ provider regulated under the ACP shall be calculated by multiplying the provider's service area population as of July 1 of the calendar year by a GPCD rate of -7 and then multiplying that product by the number of days in the calendar year. If the account balance exceeds the maximum negative account balance after any debits are registered, the balance carried forward shall equal the maximum negative account balance allowed in the provider's flexibility account for that year.*

C. Compliance Status

If the adjustment to a large municipal provider's flexibility account following a calendar year as provided for in subsection A or B of this section causes the account to have a negative account balance which exceeds the maximum negative account balance allowed in the provider's flexibility account for the year as calculated in subsection A, paragraph 3, or subsection B, paragraph 3, the provider is out of compliance for that calendar year.

5-107. Conservation Requirements for Institutional Providers

A. *If a large municipal provider operates primarily for the purpose of serving water to institutions, including prisons, hospitals, military installations, airparks, and schools, and supplies or expects to supply more than 90 percent of its total non-irrigation deliveries to one or more of these institutions, the provider may apply to the director for designation as an institutional provider. The director may deem a facility other than one of those listed above as an institution if its water use characteristics are similar to the types of institutions listed above.*

B. *A large municipal provider regulated as an institutional provider in the Second Management Plan may reapply to the director to be designated as an institutional provider under the Third Management Plan any time after it has been noticed of its total GPCD requirements for the Third Management Plan.*

C. *A large municipal provider applying for designation as an institutional provider shall apply on a form prescribed and furnished by the director. The large provider shall provide information in sufficient detail to allow the director to evaluate the provider's conservation potential and to establish appropriate conservation requirements for the provider.*

D. *The director shall approve a large municipal provider's application for designation as an institutional provider if the provider meets the criteria in subsection A of this section and demonstrates that it does not qualify for the NPCCP or the ACP.*

E. *Each large municipal provider designated as an institutional provider shall be assigned mandatory conservation requirements and monitoring and reporting requirements, including a maximum residential GPCD requirement and appropriate conservation measures for non-residential uses. The institutional provider shall comply with the assigned conservation requirements by the date specified by the director, but not later than January 1 of the year following the year in which the provider's application is approved, and shall remain in compliance with those requirements until the first compliance date for any substitute requirements in the Fourth Management Plan.*

5-108. Consolidation of Municipal Provider Service Areas; Acquisition of a Portion of Another Municipal Provider's Service Area

A. Notification

1. *If two or more municipal providers consolidate their service areas into one service area, the consolidated provider shall notify the Department of the consolidation within 30 days after the consolidation becomes effective.*

2. *If a municipal provider acquires a portion of another municipal provider's existing service area, both the acquiring provider and the conveying provider shall notify the Department of the acquisition within 30 days after the acquisition becomes effective.*

B. Regulation of Consolidated Provider

1. *Upon consolidation, a consolidated provider that qualifies as a large municipal provider shall be regulated under the Total GPCD Program described in section 5-103, unless the consolidated provider applies for and is accepted for regulation under the NPCCP described in section 5-104 or the ACP described in section 5-105.*

2. *If the consolidated provider is regulated under the Total GPCD Program, the director shall establish a total GPCD requirement for the consolidated provider consistent with the methodology used by the director to establish the consolidating providers' total GPCD requirements as set forth in Appendix 5C.1. The director shall also establish and maintain a flexibility account for the consolidated provider in accordance with section 5-106, subsection A, with a beginning balance to be established by the director based on the ending balances in the flexibility accounts of the consolidating providers.*

3. *If the consolidated provider is accepted for regulation under the ACP, the director shall establish a residential GPCD requirement for the consolidated provider consistent with the methodology used by the director to establish the consolidating providers' residential GPCD requirements as set forth in Appendix 5I. The director shall also establish and maintain a flexibility account for the consolidated provider in accordance with section 5-106, subsection B, with a beginning balance to be established by the director based on the ending balances in the flexibility accounts of the consolidating providers.*

4. *If the consolidated provider applies for regulation under the NPCCP or the ACP and one of the consolidating providers was regulated under that program immediately prior to consolidation, the consolidated provider's application for regulation under the program shall include only the information required by section 5-104 or section 5-105 that has changed since the consolidating provider filed its application for the program.*

C. Regulation of Acquiring Provider

1. *Except as provided in paragraph 2 of this subsection, a large municipal provider that acquires a portion of another provider's existing service area shall continue to be regulated under the conservation program that the acquiring provider was regulated under immediately prior to the acquisition.*

2. *If the acquiring provider was regulated under either the NPCCP described in section 5-104 or the ACP described in section 5-105 immediately prior to the acquisition, the acquiring provider shall be regulated under the Total GPCD Program beginning on January 1 of the first calendar year after the acquisition unless the provider reapplies to be regulated under the NPCCP or the ACP, whichever is applicable, within 180 days after the acquisition. If the acquiring provider reapplies to be regulated under the NPCCP or the ACP within 180 days after the acquisition, both of the following shall apply:*

   a. *The provider shall continue to be regulated under the NPCCP or the ACP, whichever is applicable, until the director makes a final decision on the provider's application.*

   b. *The acquiring provider's application shall include only the information required by section 5-104 or section 5-105 that has changed since the provider filed its original application for the program.*

3. *If the acquiring provider is regulated under the Total GPCD Program after the acquisition, the director shall establish a new total GPCD requirement for the provider consistent with the methodology used to establish the provider's total GPCD requirement in Appendix 5C.1, taking into account the addition to the provider's service area. The director may also adjust the balance in the acquiring provider's flexibility account maintained under section 5-106, subsection A, to take into account the balance in the conveying provider's flexibility account at the time of the conveyance.*

4. *If the acquiring provider is regulated under the ACP after the acquisition, the director shall establish a new residential GPCD requirement for the provider consistent with the methodology used to establish the residential GPCD requirements in Appendix 5I, taking into account the addition to the provider's service area. The director may also adjust the balance in the acquiring provider's flexibility account maintained under section 5-106, subsection A, to take into account the balance in the conveying provider's flexibility account at the time of the conveyance.*

D. Regulation of Conveying Provider

1. *Except as provided in paragraph 2 of this subsection, a large municipal provider that conveys a portion of its service area to another provider and that qualifies as a large municipal provider after the conveyance shall continue to be regulated under the conservation program that the provider was regulated under immediately prior to the conveyance.*

2. *If the conveying provider was regulated under either the NPCCP described in section 5-104 or the ACP described in section 5-105 immediately prior to the acquisition and if the conveying provider qualifies as a large municipal provider after the conveyance, the conveying provider shall be regulated under the Total GPCD Program beginning on January 1 of the first calendar year after the acquisition unless the provider reapplies to*

be regulated under the NPCCP Program or the ACP, whichever is applicable, within 180 days after the conveyance. If the conveying provider reapplies to be regulated under the NPCCP or the ACP within 180 days after the conveyance, both of the following shall apply:

a. *The provider shall continue to be regulated under the NPCCP or the ACP, whichever is applicable, until the director makes a final decision on the provider's application.*

b. *The provider's application shall include only the information required by section 5-104 or section 5-105 that has changed since the provider filed its original application for the program.*

3. *If the conveying provider is regulated under the Total GPCD Program after the conveyance, the director shall establish a new total GPCD requirement for the provider consistent with the methodology used to establish the total GPCD requirements in Appendix 5C.1, taking into account the reduction in the provider's service area. The director may also adjust the balance in the conveying provider's flexibility account maintained under section 5-106 to take into account the reduction in the provider's service area.*

4. *If the conveying provider is regulated under the ACP after the conveyance, the director shall establish a new residential GPCD requirement for the provider consistent with the methodology used to establish the residential GPCD requirements in Appendix 5I, taking into account the reduction in the provider's service area. The director may also adjust the balance in the conveying provider's flexibility account maintained under section 5-106 to take into account the reduction in the provider's service area.*

5-109. Conservation Requirements for New Large Municipal Providers

A. Total GPCD Program

1. *A new large municipal provider shall be assigned to the Total GPCD Program described in section 5-103 and shall comply with its annual total GPCD requirement no later than the second full calendar year after the provider is given written notice of the requirement by the director and for each calendar year thereafter until the first compliance date for any substitute requirement in the Fourth Management Plan.*

2. *A new large municipal provider's total GPCD requirement for a year shall be calculated as follows:*

   a. *For calendar years 2002 through 2004, multiply the provider's existing residential population for the year, as calculated pursuant to section 5-103, by the provider's first intermediate GPCD component for existing residential population as determined by the director after the provider qualifies as a new large provider. In determining the provider's first intermediate GPCD component for existing residential population, the director shall assume the implementation of conservation measures appropriate for the characteristics of the provider's existing service area population for calendar years 2002 through 2004, taking into consideration already existing conservation measures.*

      For calendar years 2005 through 2009, multiply the provider's existing residential population for the year, as calculated pursuant to section 5-103, by the provider's *second intermediate GPCD component for existing residential population as determined by the director after the provider qualifies as a new large provider. In determining the provider's second intermediate GPCD component for existing residential population, the director shall assume the implementation of conservation measures appropriate for the characteristics of the provider's existing service area population for calendar years 2005 through 2009, taking into consideration already existing conservation measures.*

For the calendar year 2010 and for each calendar year thereafter until the first compliance date for any substitute total GPCD requirement in the Fourth Management Plan, multiply the provider's existing residential population for the year, as calculated pursuant to section 5-103, by the provider's final GPCD component for existing residential population as determined by the director after the provider qualifies as a new large provider. In determining the provider's final GPCD component for existing residential population, the director shall assume the implementation of conservation measures appropriate for the characteristics of the provider's existing service area population beginning in calendar year 2010, taking into consideration already existing conservation measures.

b. *Multiply the provider's new single family population for the year, as calculated pursuant to subsection D of section 5-103, by 57 GPCD.*

c. *Multiply the number of new single family housing units within the provider's service area as of July 1 of the calendar year by 107 GPHUD.*

d. *Multiply the new multifamily population for the year, as calculated pursuant to subsection D of section 5-103, by 57 GPCD.*

e. *Multiply the number of new multifamily housing units within the provider's service area as of July 1 of the calendar year by 26 GPHUD.*

f. *Determine the provider's non-residential GPCD by dividing the total non-residential water delivered, in gallons, during the calendar year by the service area population for the calendar year, as calculated pursuant to subsection D of section 5-103, and dividing by the number of days in the calendar year. The non-residential GPCD component equals the non-residential GPCD rate for the calendar year up to 21 GPCD. If the non-residential GPCD rate for the calendar year is greater than 21 GPCD, the non-residential component shall be 21 GPCD.*

g. *Divide the provider's allowable lost and unaccounted for water by the number of days in the calendar year. The provider's allowable lost and unaccounted for water is the lesser of the following:*

   1) *the provider's actual lost and unaccounted for water for the year, in gallons.*

   2) *an amount calculated by multiplying the total gallons of water from any source, except direct use effluent, withdrawn, diverted, or received by the provider during the year for non-irrigation uses by 10 percent.*

h. *Add the results from paragraphs a through g of this section and then divide the sum by the provider's annual service area population as of July 1 of that year, as* *determined pursuant to section 5-103, subsection D. The quotient is the provider's total GPCD requirement for the calendar year.*

3. *The director shall determine if a new large municipal provider is in compliance with its annual total GPCD requirement pursuant to the flexibility account provisions in section 5-106.*

B. Non-Per Capita Conservation Program

A new large municipal provider may apply for regulation under the NPCCP in accordance with section 5-104.

C. Alternative Conservation Program

1. *Application*

   A new large municipal provider may apply for regulation under the ACP in accordance with section 5-105.

2. *Consistency with AMA Management Goal Requirement*

   A new large municipal provider regulated under the Alternative Conservation Program shall comply with the consistency with AMA management goal requirements set forth in Section 5-105, subsection C, paragraph 1.

3. *Annual Residential GPCD Requirement*

   a. *Requirement*

      A new large municipal provider regulated under the ACP shall comply with its annual residential GPCD requirement for each calendar year as described in section 5-105, subsection C, paragraph 2, subparagraph a.

   b. *Calculation of Annual Residential GPCD Requirement*

      Each year the annual residential GPCD requirement for a new large municipal provider regulated under the ACP shall be calculated as follows:

      1) *Multiply the provider's existing residential population for the year, as calculated pursuant to section 5-103, subsection D, by the GPCD component for existing residential population as determined by the director. The GPCD components shall assume the implementation of conservation measures appropriate for the characteristics of the provider's service area, taking into consideration already existing conservation measures.*

      2) *Multiply the provider's new single family population for the year, as calculated pursuant to section 5-103, subsection D, by 57 GPCD.*

      3) *Multiply the number of new single family housing units within the provider's service area as of July 1 of the calendar year in question by 107 GPHUD.*

4) Multiply the new multifamily population for the year, as calculated pursuant to subsection D of section 5-103, by 57 GPCD.

5) Multiply the number of new multifamily housing units within the provider's service area as of July 1 of the calendar year in question by 26 GPHUD.

6) Add the products from items 1 through 5 of this subparagraph and then divide the sum by the provider's service area population as of July 1 of the calendar year. The quotient is the provider's residential GPCD requirement for the calendar year.

c. Compliance with Annual Residential GPCD Requirement

The director shall determine if a new large municipal provider regulated under the ACP is in compliance with its annual residential GPCD requirement pursuant to the flexibility account provisions in section 5-106.

4. Non-Residential Conservation Programs

A new large municipal provider regulated under the ACP shall implement conservation programs for its non-residential customers in accordance with section 5-105, subsection C, paragraph 3.

5-110. Conservation Requirements for Small Municipal Providers

By January 1, 2002 or upon commencement of service of water, whichever is later, and until the first compliance date for any substitute requirements in the Fourth Management Plan, a small municipal provider shall adopt and implement a program to achieve the following goals:

1. Minimize waste of all water supplies.

2. Maximize efficiency in outdoor watering.

3. Encourage reuse of water supplies.

4. Reduce its total GPCD usage.

5-111. Individual User Requirements for Municipal Providers and Individual Users

A. Individual User Requirements

Beginning January 1, 2002, or upon commencement of service of water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Fourth Management Plan, the municipal provider or individual user responsible for compliance with the individual user requirements under subsection B of this section shall comply with the following, as applicable:

1. The municipal provider or individual user shall serve water to, or use water within, a turf-related facility only in accordance with sections 6-302 through 6-305 of the Industrial Chapter of the Third Management Plan, and shall comply with the monitoring and reporting requirements set forth in section 6-203 of the Industrial Chapter, as though *the individual user were an industrial user. The person responsible for compliance shall also comply with the requirements contained in section 6-202 of the Industrial Chapter, if applicable, as though the individual user were an industrial user.*

2. *The municipal provider or individual user shall serve or use water, other than stored water, withdrawn from a well for the purpose of watering landscaping plants planted on or after January 1, 1987 within any publicly owned rights-of-way of a highway, street, road, sidewalk, curb or shoulder which is used for travel in any ordinary mode, including pedestrian travel, only if the plants are listed in Appendix 5B. The director may waive this requirement upon request from the municipal provider or individual user if a waiver of this requirement is in the public interest. This requirement does not apply to any portion of a residential lot that extends into a publicly owned rights-of-way.*

3. *The municipal provider or individual user shall not serve or use water, other than stored water, withdrawn from a well for the purpose of maintaining a water feature, including fountains, waterfalls, ponds, water courses, and other artificial water structures, installed after January 1, 2002 within any publicly owned rights-of-way of a highway, street, road, sidewalk, curb or shoulder which is used for travel in any ordinary mode, including pedestrian travel. The director may waive this requirement upon request from the municipal provider or individual user if a waiver of this requirement is in the public interest. This requirement does not apply to any portion of a residential lot that extends into a publicly owned rights-of-way.*

B. Responsibility for Compliance with Individual User Requirements

1. *A municipal provider shall be responsible for complying with an individual user requirement set forth in subsection A of this section for an existing individual user unless one of the following applies:*

   a. *The provider identified the existing individual user to the director on a form provided by the Department and received by the director no later than 90 days before the adoption of the Third Management Plan.*

   b. *The director gave written notice of the individual user requirement to the individual user within 30 days after the adoption of the Third Management Plan.*

2. *An existing individual user that has been given written notice of an individual user requirement by the director shall be responsible for complying with the individual user requirement beginning on the date specified in the notice.*

3. *A municipal provider shall be responsible for complying with an individual user requirement set forth in subsection A of this section for a new individual user unless one of the following applies:*

   a. *The municipal provider identifies the new individual user to the director on a form provided by the Department. If the provider identifies the new individual user to the director within 90 days after the provider begins serving water to the new individual user, the municipal provider shall not be responsible for complying with the individual user requirement at any time. If the provider identifies the new individual user to the director more than 90 days after the provider begins serving water to the new individual user, the provider shall be responsible for complying with the individual user requirement beginning on the date the new individual first receives* *water from the provider until the end of the calendar year in which the provider identifies the individual user to the director.*

b. *The director has given written notice of the individual user requirement to the individual user and the individual user is responsible for complying with the requirement.*

4. *A new individual user that has been given written notice of an individual user requirement by the director shall be responsible for complying with the individual user requirement beginning on the date specified in the notice.*

C. Notification of New Individual User by Municipal Provider

Beginning January 1, 2002 and continuing thereafter until the first compliance date for any substitute requirement in the Fourth Management Plan, a municipal provider shall notify a new individual user in writing of its individual user requirements as set forth in subsection A of this section before commencement of service of water to the individual user.

5-112. Conservation Requirements for Municipal Distribution Systems

For the calendar year 2002 or the calendar year in which the provider commences service of water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Fourth Management Plan:

1. *A large municipal provider shall not operate a municipal distribution system in a manner such that lost and unaccounted for water exceeds 10 percent of the total quantity of water from any source, except direct use effluent, withdrawn, diverted, or received by the large municipal provider on an annual or three-year average basis.*

2. *A small municipal provider shall not operate its municipal distribution system in a manner such that lost and unaccounted for water exceeds 15 percent of the total quantity of water from any source, except direct use effluent, withdrawn, diverted, or received by the small municipal provider on an annual or three-year average basis.*

5-113. Monitoring and Reporting Requirements for Municipal Providers and Individual Users

For the calendar year 2002 or for the calendar year in which the municipal provider commences service of water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Fourth Management Plan:

1. *A large municipal provider shall separately measure and report in its annual reports required by A.R.S. §§ 45-468 and 45-632 the total quantity of water from any source, including effluent, delivered each month for: (a) irrigation uses; (b) residential uses by category, including single family and multifamily; (c) non-residential uses by category, including commercial uses, industrial uses, government uses, construction uses, and other uses; and (d) turf-related facility use.*

2. *A municipal provider shall report the following in its annual report required by A.R.S. § 45-632:*

   a. *The total quantity of water from any source, disaggregated by each source, withdrawn, diverted, or received by the provider for non-irrigation use during the* *reporting year, as separately measured with a measuring device in accordance with paragraph 6 of this subsection.*

b. *The total quantity of water from any source, including effluent, withdrawn, diverted, or received by the provider for irrigation use during the reporting year.*

c. *The total quantity of effluent, disaggregated by direct use effluent, effluent recovered within the area of impact, and effluent recovered outside the area of impact, served by the provider during the reporting year for non-irrigation use.*

d. *The number of single family housing units added to the provider's service area from July 1 of the previous calendar year to July 1 of the reporting year.*

e. *The number of multifamily housing units added to the provider's service area from July 1 of the previous calendar year to July 1 of the reporting year.*

f. *The total number of single family housing units and multifamily housing units served by the provider as of July 1, 2000.*

g. *The number of single family housing units and the number of multifamily housing units added to the provider's service area between July 1, 2000 and July 1 of the reporting year.*

h. *The provider's total quantity of lost and unaccounted for water during the calendar year.*

i. *The percentage of the total quantity of water from any source, except effluent, withdrawn, diverted, or received by the provider during the calendar year that is lost and unaccounted for water.*

3. *In addition to the information required by paragraphs 1 and 2 of this section, a large municipal provider regulated under the NPCCP described in section 5-104 shall include the following in its annual report required by A.R.S. § 45-632:*

   a. *The information listed in the monitoring and reporting requirement sections of those RCMs set forth in Appendix 5H.- 2 and 4 that the provider agrees in writing to implement pursuant to section 5-104, subsection E, paragraph 1.*

   b. *If the provider applied for the NPCCP under section 5-104, subsection A, paragraph 4, the information required to be submitted by the provider under the AWS Rules adopted by the director pursuant to A.R.S. § 45-576.*

   c. *Any other information required by the director in order to determine the provider's compliance with the NPCCP.*

4. *In addition to the information required by paragraphs 1 and 2 of this section, a large municipal provider regulated under the ACP described in section 5-105 shall include in its annual report required by A.R.S. § 45-632:*

   a. *A status report describing progress in implementing the provider's programs proposed in its application, specifically including the provider's proposed conservation plan.*

b. The information listed in the monitoring and reporting requirement sections of those RCMs set forth in Appendix 5H.1-4 that the provider agrees in writing to implement pursuant to section 5-105, subsection C, paragraph 3.

5. A large municipal provider shall meter water deliveries to all service connections on its municipal distribution system, except connections to fire services, dwelling units in individual multifamily units, mobile homes in a mobile home park with a master meter, and construction users.

6. A municipal provider shall make all water use measurements using measuring devices in accordance with the Department's measuring device rules, R12-15-901, et seq., Arizona Administrative Code.

7. An individual user shall comply with the monitoring and reporting requirements prescribed in the Industrial Chapter, if applicable, as though the individual user were an industrial user.

5-114. Remediated Groundwater Accounting for Conservation Requirements

A. Accounting

Groundwater withdrawn pursuant to an approved remedial action project under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, and used by a person subject to a conservation requirement established under this chapter, shall be accounted for consistent with the accounting for surface water for purposes of determining the person's compliance with the conservation requirement, subject to the provisions of subsections B through D of this section.

B. Amount of Groundwater Eligible for Accounting

For each approved remedial action project, the annual amount of groundwater that is eligible for the remediated groundwater accounting provided in subsection A of this section is the project's annual authorized volume. The annual authorized volume for a remedial action project approved on or after June 15, 1999 is the maximum annual volume of groundwater that may be withdrawn pursuant to the project, as specified in a consent decree or other document approved by the United States Environmental Protection Agency (EPA) or the Arizona Department of Environmental Quality (ADEQ). The annual authorized volume for a project approved prior to June 15, 1999 is the highest annual use of groundwater withdrawn pursuant to the project prior to January 1, 1999, except that if a consent decree or other document approved by the EPA or ADEQ specifies the maximum annual volume of groundwater that may be withdrawn pursuant to the project, the project's annual authorized volume is the maximum annual volume of groundwater specified in that document. The director may modify the annual authorized volume for a remedial action project as follows:

1. For an approved remedial action project associated with a treatment plant that was in operation prior to June 15, 1999, a person may request an increase in the annual authorized volume at the same time the notice is submitted pursuant to subsection C of this section. The director shall increase the annual authorized volume up to the maximum treatment capacity of the treatment plant if adequate documentation is submitted to the director demonstrating that an increase is necessary to further the purpose of the remedial action project and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.

2. *A person may request an increase in the annual authorized volume of an approved remedial action project at any time if it is necessary to withdraw groundwater in excess of the annual authorized volume to further the purpose of the project. The director shall increase the annual authorized volume up to the maximum volume needed to further the purpose of the project if adequate documentation justifying the increase is submitted to the director and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.*

3. *The director shall modify the annual authorized volume of an approved remedial action project to conform to any change in the consent decree or other document approved by the EPA or ADEQ if the person desiring the modification gives the director written notice of the change within thirty days after the change. The notice shall include a copy of the legally binding agreement changing the consent decree or other document approved by the EPA or ADEQ.*

C. Notification

To qualify for the remediated groundwater accounting provided in subsection A of this section, the person desiring the accounting must notify the director in writing of the anticipated withdrawal of groundwater pursuant to an approved remedial action project under CERCLA or Title 49, Arizona Revised Statutes, prior to the withdrawal. A municipal provider may submit notice on behalf of an individual user. At the time the notice is given, the person desiring the accounting must be using remediated groundwater pursuant to the approved remedial action project or must have agreed to do so through a consent decree or other document approved by the EPA or ADEQ. The notice required by this subsection shall include all of the following:

1. *A copy of a document approved by ADEQ or the EPA, such as the Remedial Action Plan (RAP), Record of Decision (ROD) or consent decree, authorizing the remediated groundwater project. Unless expressly specified in the document, the person shall include in the notice the volume of groundwater that will be pumped annually pursuant to the project, the time period to which the document applies, and the annual authorized volume of groundwater that may be withdrawn pursuant to the project.*

2. *The purpose for which the remediated groundwater will be used.*

3. *The name and telephone number of a contact person.*

4. *Any other information required by the director.*

D. Monitoring and Reporting Requirements

To qualify for the remediated groundwater accounting for conservation requirements as provided in subsection A of this section, groundwater withdrawn pursuant to the approved remedial action project must be metered separately from groundwater withdrawn in association with another groundwater withdrawal authority for the same or other end use. A person desiring the remediated groundwater accounting for conservation requirements shall indicate in its annual report under A.R.S. § 45-632 the volume of water withdrawn and used during the previous calendar year that qualifies for the accounting.

REFERENCES

Craft, M., 1997. *Draft Summary of Landscape Survey Results*, for ADWR, unpublished.

Karpiscak, et al., 1998. *Evaporative Cooler Water Use in Phoenix*, Journal, American Water Works Association Vol.90, Issue 4 (April 1998).

Pima County Cooperative Extension Service, Low4 Program, 1996. *How to Develop a Drip Irrigation Schedule* and *Plant Water Requirements, Tucson, Arizona*. Landscape Water Conservation Workshop materials.

APPENDIX 5A
MUNICIPAL WATER PROVIDERS
SANTA CRUZ ACTIVE MANAGEMENT AREA

Provider	Right Number	Large Provider	Small Provider	Organization
Baca Float Land Development LP	56-000020		X	Miscellaneous
Buena Vista Ranch	56-000030		X	Miscellaneous
Citizens' Water Resources - Tubac	56-000042	X		Private Water Company
Lakewood Water Company	56-000127		X	Private Water Company
Mi Casa MHP	56-000165		X	Mobile Home Park
Mountain View Campground	56-000047		X	Miscellaneous
City of Nogales	56-000002	X		Municipality
Olivas, Filiberto	56-000336		X	Miscellaneous
Rio Rico Utilities, Inc.	56-000041	X		Private Water Company
Sedgwick, Cabot	56-000364		X	Miscellaneous
Spencer Water Company	56-000363		X	Private Water Company
Town and Country Terrace MHP	56-000219		X	Mobile Home Park
Valle Verde Water Company	56-000228	X		Private Water Company
Wingfield Cattle Company	56-000326		X	Miscellaneous

APPENDIX 5B
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

The Low Water Use/Drought Tolerant Plant List for the Santa Cruz AMA is filed in the Department's Santa Cruz AMA Office. A copy of the list, effective as of March 1998, follows in this Appendix. Since the list may be amended using the procedure described below, a current list is available upon request from the Santa Cruz AMA office or the Department's public information office in Phoenix.

PROCEDURE FOR MODIFICATION OF LOW WATER USE PLANT LIST FOR THE SANTA CRUZ ACTIVE MANAGEMENT AREA

A. A person who seeks to add a plant or plants to the Low Water Use Plant List for the Santa Cruz AMA or delete a plant or plants from the list may apply at any time to the director for a modification of the list. The application shall be made on a form prescribed and furnished by the director.

B. The director shall review each request for a modification of the list. The director may request additional information from the applicant and may seek information from other sources as may be necessary to determine whether the list should be modified.

C. If the director approves the addition of a plant to the list, the director shall place the plant on a supplemental list that shall be considered an addendum to the list. The supplemental list shall be available from the Santa Cruz AMA Office or from the public information office upon request. If the director approves the deletion of a plant from the list, the deleted plant or plants shall be listed as deleted on the supplemental list.

D. The director shall conduct an annual review of the list and issue a modified plant list no later than March 1 of the following year. As a result of the review, the director may add plants to the list, delete plants from the list, or both.

OFFICIAL REGULATORY LIST FOR:

Arizona Department of Water Resources,
Santa Cruz Active Management Area

The plants on this list can be grown with moderate to no supplemental irrigation once they are established. Occasionally, for good appearance, supplemental irrigation may be applied during the growing season. In addition to the cacti on this list, any cacti salvaged and tagged in compliance with state agricultural and horticultural regulations may be used.

Even though all of the plants on the Low Water Use/Drought Tolerant Plant List meet the Department's standard for low water consumption, please check the regulations of the governing jurisdiction to determine whether a particular plant selection meets all locational, aesthetic, or functional requirements. For example, plants used for screening may have to be evergreen, have dense foliage, and grow to required heights. On the other hand, plants used within sight visibility triangles may have height restrictions. In some applications, there may be a requirement for native materials or a "desert or natural appearance."

Some plants on the list may fall under more than one plant type category and this is noted (i.e., Acacia constricta can be grown as a tree or a shrub depending upon the growth habit that is preferred). Cultivars of plants listed may also be planted in regulated areas.

Applications for additions, deletions, or exceptions to the list may be submitted to the Department of Water Resources, Santa Cruz Active Management Area Office, for consideration. Phone: (520) 761-1814; Fax: (520) 761-1869.

APPENDIX 5B *(continued)*
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

Key to symbols

(sh)	Semi-hardy -- some dieback in a hard frost
(t)	Tender -- severely damaged or killed in a hard frost
*	Toxic; may be harmful if eaten For more information, call Arizona Poison Control Center at 626-6016
#	Exceptions to the nomenclature in Hortus III
A	Accent Plant
an	Annual
C	Cactus
cl	Seasonal Color (showy flowers, fall color or berries)
Gc	Groundcover
Gr	Ornamental Grass
I	Invasive -- may spread and intrude into natural areas
p	Perennial
S	Shrub
Sc	Succulent (other than cacti)
T	Tree
V	Vine
CD	Chihuahuan Desert Region - broadly interpreted to include a large area of north central and northwest Mexico, southwest Texas, southern New Mexico, and extreme southeast Arizona
SD	Sonoran Desert Region - broadly interpreted to include the arid and semi-arid areas of northwest Mexico, southeast California, and most of Arizona south of the Mogollon Rim

Note: Chihuahuan and Sonoran Desert Regions annotated by Matt Johnson, Native Plant Society.

Approximate Watering Needs (depending on soil and climate conditions)

1	No supplemental irrigation once established.
2	Once a month during the growing season once established.
3	Twice a month during the growing season once established.
4	Once a week during the growing season once established.

APPENDIX 5B *(continued)*
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

Plant Type Category	Region	Low Water Use/ Drought Tolerant Plant List	Watering Needs		
Gc,an	SD	Abronia villosa	1		Sand verbena
T	Africa	Acacia abyssinica	3	(sh)	Abyssinian Acacia
T	Austr.	Acacia aneura	2	(sh)	Mulga
S	SD	Acacia angustissima	2	(sh)	White Ball Acacia
S,T	CD	Acacia berlandieri	3		Guajillo
T,S*	SD,CD	Acacia constricta	1		Whitethorn Acacia, Mescat
T,S	Austr.	Acacia crasspedocarpa	1		Waxleaf Acacia
T,S	Austr.	Acacia cultriformis	2	(sh)	Knife-Leaf Acacia
T,S	SD,CD	Acacia greggii	1		Cat's Claw Acacia
T,S,cl	SD,CD	Acacia minuta (smallii)	2		Southwestern Sweet Acacia
S	Austr.	Acacia notabilis	2		Acacia
S,Gc	Austr.	Acacia redolens	2		Prostrate Acacia
S,T	CD	Acacia rigidula	3		Black Brush Acacia
T,cl	Austr.	Acacia salicina	2	(sh)	Weeping Wattle
T	Austr.	Acacia saligna	1-2	(sh)	Wattle Tree
T	CD	Acacia schaffneri	1-2		Twisted Acacia
T	Austr.	Acacia stenophylla	1-2		Pencilleaf Acacia
T	SD	Acacia willardiana	1-2	(sh)	Palo Blanco
Sc	CD	Agave americana	1-2		Century Plant
Sc	SD	Agave colorata	1		Agave
Sc	CD	Agave filifera	1-2		Agave
Sc	Mex.	Agave geminiflora	2	(sh)	Twin-flowered agave
Sc	SD	Agave huachucensis	1-2		Huachuca Agave
Sc	CD	Agave lophantha (univittata)	2		Agave
Sc	SD	Agave ocahui	1-2		Ocahui Agave
Sc	SD	Agave palmeri	1		Palmer Agave
Sc	Mex.	Agave parryi v. truncata	2		Artichoke Agave
Sc	CD	Agave victoriae-reginae	1-2		Victoria Regina Agave
Sc	SD	Agave vilmoriniana	1-2	(sh)	Octopus Agave
Sc,cl	Africa	Aloe barbadensis	2-3	(sh)	Barbados Aloe
Sc,cl	Africa	Aloe ferox	2-3	(sh)	Cape Aloe
Sc,cl	Africa	Aloe saponaria	2-3	(sh)	Mediterranean Aloe
Sc, cl	Africa	Aloe variegata	2-3		Partridge Breast Aloe
S	SD,CD	Aloysia gratissimma	2		Fragrant Bush, Bee Brush
S	SD,CD	Aloysia wrightii	2		Wright's Oregano, Lemon Verbena
S	SD	Ambrosia (Franseria) deltoidea	1		Triangle-leaf Bursage
S	SD	Ambrosia (Franseria) dumosa	1		White Bursage
S	SD	Anisacanthus thurberi	2		Desert Honeysuckle
V,cl	SD	Antigonon leptopus	2-3	(t)	Queen's Wreath
Gr,cl	SD,CD	Aristida purpurea	1		Purple three-awn
S	SD,CD	Asclepias linaria	2		Pine-Leaf Milkweed

APPENDIX 5B *(continued)*
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

Plant Type Category	Region	Low Water Use/ Drought Tolerant Plant List	Watering Needs		
A	SD	Asclepias subulata	2	(sh)	Desert Milkweed
an	SD	Aster bigelovii	1	(t)	Aster
an	SD,CD	Aster tanacetifolius	1	(t)	Aster
S	SD,CD	Atriplex canescens	1		Four-Wing Saltbush
S	SD	Atriplex lentiformis	1		Quail Bush
S	SD	Atriplex lentiformis breweri	1-2		Brewer Saltbush
S	Austr.	Atriplex nummularia	1		Old Man Saltbush
S	SD	Atriplex polycarpa	1		Desert Saltbush
S	Austr.	Atriplex semibaccata	2		Australian Saltbush
S,I	SD	Baccharis sarothroides (male only)	1-2		Desert Broom
S,Gc	SD	Baccharis sarothroides 'Centennial'	2-3		Centennial
p,cl	SD	Bahia absinthifolia	2		Desert Daisy
p,cl*	SD,CD	Baileya multiradiata	1-2		Desert Marigold
S	SD	Berberis harrisoniana	3		Barberry
S	SD	Berberis trifoliata	3		Agritos
Gr,cl	SD,CD	Bothriochloa barbinodis	1		Cane beardgrass
V,S,cl	Brazil	Bougainvillea spp.	3	(t)	Bougainvillea
Gr	SD,CD	Bouteloua chondrosioides	2		Sprucetop grama
Gr,cl	SD,CD	Bouteloua curtipendula	2		Sideoats grama
Gr,cl	SD	Bouteloua eriopoda	3		Black Grama
Gr	SD,CD	Bouteloua gracilis	2		Blue grama
Gr	SD	Bouteloua hirsuta	2		Hairy grama
Gr	SD,CD	Bouteloua rothrockii	1		Rothrock grama
T	Austr.	Brachychiton populneus	2-3		Bottle Tree
T	SD	Brahea (Erythea) armata	2-3		Mexican Blue Palm
Gr	CD	Buchloe dactyloides	2-3		Buffalo grass
S,cl	CD	Buddleia marrubifolia	2-3		Wooly Butterfly Bush
Sc,cl	S. Afr.	Bulbine frutescsns	2	(sh)	Shrubby bulbine
S,cl*	CD	Caesalpinia (Poinciana) mexicana	2		Mexican Bird of Paradise (Yellow)
S,cl*	Argent.	Caesalpinia (Poinciana) gilliesii	1-2		Yellow Bird of Paradise
S,cl*	Carib.	Caesalpinia pulcherrima	3	(sh)	Red Bird of Paradise
S,cl	SD	Calliandra californica	2-3		Red Fairy Duster, Baja Fairy Duster
S,cl	SD	Calliandra eriophylla	1		Fairy Duster, False Mesquite
S,cl	SD	Calliandra peninsularis	2-3	(sh)	Red Calliandra, Baja Fairy Duster
T,S,cl	Austr.	Callistemon citrinus	3	(sh)	Lemon Bottlebrush
Gc,cl	CD	Calylophus hartwegii	3		Calylophus
V,cl	SD,CD	Campsis radicans	2-3		Common Trumpet Creeper
C	SD	Carnegiea gigantea	1		Saguaro

APPENDIX 5B *(continued)*
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

Plant Type Category	Region	Low Water Use/ Drought Tolerant Plant List	Watering Needs		
Gc,Sc,cl	Africa	Carpobrotus edulis	3	(t)	Ice Plant
S,cl	Austr.	Cassia artemisioides	2-3	(sh)	Wormwood Senna, Feathery Cassia
S,cl	Austr.	Cassia nemophila (eremophila)	2		Green Cassia
S,cl	Austr.	Cassia phyllodinea	2-3		Silvery Cassia
T	Austr.	Casuarina cunninghamiana	3		Australian Pine
T	Austr.	Casuarina stricta	2-3		Coast Beefwood
T,cl		Catalpa x chilopsis	4		Chitalpa
Gr,cl	SD	Cathostecum erectum	1		False grama
S	SD,CD	Celtis pallida	1-2		Spiny or Desert Hackberry
T	SD,CD	Celtis reticulata	2		Netleaf or Western Hackberry
p,cl	Medit.	Centaurea cineraria	3		Dusty Miller
Gc,Sc,cl		Cephalophyllum `Red Spike'	2		Red Spike Ice Plant
T	Medit.	Ceratonia siliqua	3	(sh)	Carob, St. John's Bread Tree
T,cl	SD	Cercidium floridum	2-3		Blue Palo Verde
T,cl	SD,CD	Cercidium hybrid 'Desert Museum'	1		Desert Museum Palo Verde
T,cl	SD	Cercidium microphyllum	1		Littleleaf or Foothill Palo Verde
T,cl	SD	Cercidium praecox	2	(sh)	Palo Brea
T,cl	SD	Cercidium sonorae	1-2		Sonoran Palo Verde
T,S	CD	Cercis canadensis var. mexicana	3		Mexican Redbud
C	S. Am.	Cereus peruvianus	1-2	(sh)	Peruvian Cereus
T	Spain	Chamaerops humilis	2-3		Mediterranean Fan Palm
T,S,cl	SD,CD	Chilopsis linearis	2-3		Desert Willow
S,cl		Chrysactinia mexicana	3		Damianita
V,I	CD	Cissus incisa	1-2		Desert Grape Ivy
V	SD	Cissus trifoliata	1-2		Desert Grape Ivy
S	SD,CD	Condalia warnockii var. kearneyana	1		Condalia
S,Gc,cl*	Medit.	Convolvulus cneorum	1-2		Bush Morning Glory
Gc,cl	Africa	Convolvulus mauritanicus	3	(sh)	Ground Morning Glory
T,S,cl	CD	Cordia boissieri	2-3	(sh)	Anacahuita, Texas Olive
S,cl	SD,CD	Cordia parvifolia	1-2		Littleleaf Cordia
Gr	Arg.	Cortaderia selloana	3		Pampas Grass
T	SD,CD	Cupressus arizonica	2		Arizona Cypress
T	SD	Cupressus glabra	2-3		Smooth Bark Cypress
T	India	Dalbergia sissoo	3	(sh)	Rosewood
S	SD	Dalea bicolor var. argyrea	2-3		Silver Dalea
Gc,cl	Mexico	Dalea capitata	3		Yellow Dalea

APPENDIX 5B *(continued)*
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

Plant Type Category	Region	Low Water Use/ Drought Tolerant Plant List	Watering Needs		
S,cl	CD	Dalea frutescens	2-3		Black Dalea
Gc	CD	Dalea greggii	2-3		Trailing Indigo Bush
S,cl	SD	Dalea pulchra	2-3		Indigo Bush
S,cl	SD	Dalea versicolor var. sessilis	3		Indigo Bush, Dalea
A	CD	Dasylirion acrotriche	1		Green Desert Spoon
A	SD,CD	Dasylirion wheeleri	1		Sotol, Desert Spoon
Gc,p,cl*	SD	Datura wrightii	3	(sh)	Sacred Datura
Gr	SD,CD	Digitaria californica	1		Arizona cottontop
an,cl	S. Afr.	Dimorphotheca sinuata	4		African Daisy, Cape Marigold
S	SD,CD	Dodonaea viscosa	1-2	(sh)	Hopbush
Gc,p,cl	SD,CD	Dyssodia acerosa	2-3		Dogweed
Gc,an,p,cl	SD,CD	Dyssodia pentachaeta	2-3		Dyssodia
C,cl	SD	Echinocactus grusonii	1-2		Golden Barrel
C,cl	CD,SD	Echinocereus spp.	1		Hedgehog, Rainbow Cactus
C,cl	S. Am.	Echinopsis spp.	1		Easter Lily, Sea Urchin Cactus
S,cl	SD	Encelia californica	1-2	(sh)	California Brittlebush (green)
S,cl	SD	Encelia farinosa	1-2	(sh)	Brittlebush
S	SD	Ephedra nevadensis	3		Ephedra
Gr	SD,CD	Eragrostis intermedia	1		Plains lovegrass
S,cl	Austr.	Eremophila decipiens	1		Emu Bush
Gr	SD,CD	Erioneuron pulchellus	1		Fluffgrass
an,cl	SD	Eschscholtzia californica	2-3		California Poppy
an,cl	SD	Eschscholtzia mexicana	3		Mexican Gold Poppy
T	Austr.	Eucalyptus camaldulensis	2		Red River Gum
T	Austr.	Eucalyptus campaspe	2-3	(sh)	Silver Gimlet
T	Austr.	Eucalyptus formanii	2		Eucalyptus
T,cl	Austr.	Eucalyptus leucoxylon (rosea)	2		White Iron Bark
T	Austr.	Eucalyptus microtheca	1-2		Tiny Capsule Eucalyptus
T	Austr.	Eucalyptus polyanthemos	2		Silver Dollar Gum
T	Austr.	Eucalyptus rudis	2		Desert Gum
T	Austr.	Eucalyptus spathulata	3		Swamp Mallee
S	CD	Euphorbia antisyphilitica	1		Wax Plant, Candelilla
Gc		Euphorbia myrsinites	2		Euphorbia
A,Sc,cl*	Africa	Euphorbia rigida (biglandulosa)	2		Gopher Plant
T,S,cl	S. Am.	Feijoa sellowiana	3		Pineapple Guava
C,cl	SD,CD	Ferocactus spp.	1		Barrel Cactus
A,cl	SD,CD	Fouquieria splendens	1		Ocotillo
an,cl	CD	Gaillardia pulchella	3		Fire Wheel, Blanket Flower

APPENDIX 5B *(continued)*
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

Plant Type Category	Region	Low Water Use/ Drought Tolerant Plant List	Watering Needs		
Gc,cl	Africa	Gazania rigens	3-4		Treasure Flower Gazania
Gc,cl	Africa	Gazania rigens leucolaena	3-4	(t)	Trailing Gazania
T,cl	S. Am.	Geoffreya (Gourleia) decorticans	1		Chilean Palo Verde
S,cl	SD	Gossypium harknessii	2	(t)	Gossypium
S,cl	SD,CD	Haplopappus (Ericameria) laricifolius	1		Turpentine Bush
A	CD	Hesperaloe funifera	1-2		Giant Hesperaloe
A,cl	CD	Hesperaloe parviflora	1-2		Red Yucca, Red-Flowered Hesperaloe
Gr	SD	Hetropogon contortus	3		Tanglehead
S	SD,CD	Hibiscus coulteri	2		Yellow Hibiscus, Coulter's Hibiscus
Gr	SD,CD	Hilaria berlangeri	2		Curly mesquite
Gr	SD,CD	Hilaria mutica	1		Tobosa grass
Gr	SD,CD	Hilaria rigida	2		Big galleta grass
p,cl	SW US	Hymenoxys acaulis	3		Angelita Daisy
S	SD	Hyptis emoryi	3	(sh)	Desert Lavendar
S	SD	Jatropha cardiophylla	1		Limberbush
S,cl	CD	Jatropha dioica	1	(t)	Jatropha
T,S	Asia	Juniperus chinensis	3		Juniper (many culitvars)
T	SD,CD	Juniperus deppeana	3		Alligator Bark Juniper
S		Juniperus sabina	3		Sabine Juniper
S,cl	SD	Justicia (Beloperone) californica	2-3	(t)	Chuparosa
S,cl	SD	Justicia candicans	3	(sh)	Red Jacobinia
S,cl	SD	Justicia spicigera	3	(sh)	Mexican Honeysuckle, Firecracker Bush
S,cl*	S. Am.	Lantana camara	3-4	(t)	Bush Lantana (many cultivars)
Gc,cl*	S. Am.	Lantana montevidensis	3-4	(t)	Trailing Lantana
S,cl	SD,CD	Larrea tridentata (divaricata)	1		Creosote Bush, Greasewood
Gr	CD	Leptochloa dubia	3		Green Sprangle-Top
T,S,cl	CD	Leucaena retusa	1-2		Golden Leadball
S,cl	CD	Leucophyllum spp.	2		Texas Ranger (all cultivars)
Gc,an,cl	Eurasia	Linum grandiflorum `Rubrum'	3		Scarlet Flax
an,cl	SD,CD	Linum lewisii	3		Blue Flax
an,cl	SD	Lupinus arizonicus	1		Lupine
an,cl	SD	Lupinus sparsiflorus	1		Desert Lupine
an,cl	SD	Lupinus succulentus	1		Arroyo Lupine
S	SD	Lycium exsertum	1		Lycium
S	SD	Lycium fremontii	1		Wolfberry
T,S	SD	Lysiloma thornberi	2-3	(sh)	Feather Tree

APPENDIX 5B *(continued)*
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

Plant Type Category	Region	Low Water Use/ Drought Tolerant Plant List	Watering Needs		
V,cl	Amer.	Macfadyena unguis-cati	2-3		Cat's Claw Vine
Gc,Sc,cl		Malephora crocea	2-3		Croceum, Ice Plant
C,cl	SD,CD	Mamillaria spp.	1-2		Mamillaria Cactus
V,cl	CD	Mascagnia lilacina	2-3		Lavender Orchid Vine
V,cl	SD,CD	Mascagnia macroptera	2-3	(sh)	Yellow Orchid Vine
S	SD,CD	Maytenus phyllanthoides	2		Mangle Dulce
Gc,p,cl	SD,CD	Melampodium leucanthum	2		Blackfoot Daisy
V,cl	SD	Merremia aurea	2-3	(t)	Yellow Merremia
S,cl	SD	Mimosa dysocarpa	2		Velvetpod
Gr	SD	Muhlenbergia dumosa	3-4		Bush Muhlenbergia, Bamboo Muhly
Gr,cl	SD	Muhlenbergia emersleyi	1		Bullgrass
Gr,cl	SD,CD	Muhlenbergia porteri	1		Bush muhly
Gr	SD	Muhlenbergia rigens	3		Deer grass
Gr,cl	SD	Muhlenbergia rigida	3		Muhlenbergia
Gc	Austr.	Myoporum parvifolium	3		Myoporum
S	Medit.	Myrtus communis	3		True Myrtle, Roman Myrtle
S,cl		Nandina domestica	3		Heavenly Bamboo (many cultivars)
S,cl*	Medit.	Nerium oleander	2-3		Oleander (many cultivars)
A	SD	Nolina bigelovii	1-2		Beargrass
A,T	SD	Nolina matapensis	1-2		Tree Beargrass
A	SD	Nolina microcarpa	1-2		Beargrass
A	SD	Nolina parryi	1-2		Parry's Beargrass
Gc,cl	CD	Oenothera berlandieri (speciosa)	3		Mexican Evening Primrose
p,cl	SD	Oenothera caespitosa	2-3		Tufted Evening Primrose
Gc,cl	CD	Oenothera stubbei	2-3		Chihuahuan Primrose, Baja Primrose
T	Medit.	Olea europaea `Swan Hill'	3		Swan Hill Olive
T	SD,CD	Olneya tesota	1	(sh)	Desert Ironwood, Tesota
C	SD,CD	Opuntia spp.	1		Prickly Pear, Cholla
Gr	SD,CD	Oryzopsis hymenoides	3		Indian ricegrass
Gc,cl	Africa	Osteospermum fruticosum	3-4	(sh)	Trailing African Daisy
Gr	SD	Pappophorum mucronulatum	1		Pappusgrass
T,I,cl	SD,CD	Parkinsonia aculeata	1-2		Mexican Palo Verde
V	SD	Passiflora foetida	3	(sh)	Passion Flower
A,Sc,cl*	SD	Pedilanthus macrocarpus	2		Slipper Flower
Gr	Africa	Pennisetum setaceum `Cupreum'	1-2		Purple fountain grass
p,cl	W US	Penstemon ambiguus	2		Pink Plains Penstemon
p,cl	CD	Penstemon baccharifolius	1		Cutleaf Penstemon

APPENDIX 5B *(continued)*
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

Plant Type Category	Region	Low Water Use/ Drought Tolerant Plant List	Watering Needs		
p,cl	SD,CD	Penstemon barbatus	1		Beardtongue Penstemon
p,cl	SD	Penstemon eatoni	1		Eaton's Penstemon
p,cl	SW US	Penstemon palmeri	2		Palmer Penstemon
p,cl	SD	Penstemon parryi	1		Parry Penstemon
p,cl	SD	Penstemon pseudospectabilis	1		Canyon Penstemon, Mohave Beardtongue
p,cl	CD	Penstemon superbus	1		Superb Penstemon
Gc	Africa	Pentzia incana	1-2		Karoo Bush
an,cl	SD	Phacelia campanularia	2-3		Desert Canterbury Bells
an,cl	SD	Phacelia tanacetifolia	2-3		Tansy Phacelia
T		Phoenix canariensis	3		Canary Island Date Palm
T	Asia	Phoenix dactylifera	3		Date Palm
Gc,cl		Phyla nodiflora	3-4		Lippia
T		Pinus edulis	2-3		Piñon Nut Pine
T#	Asia	Pinus eldarica	2		Afghan Pine
T	Medit.	Pinus halepensis	2		Aleppo Pine
T	Mojave	Pinus monophylla	2		Singleleaf Piñon Pine
T	Medit.	Pinus pinea	2-3		Italian Stone Pine
T	Asia	Pinus roxburghii	3		Chir Pine
T	Africa	Pistacia atlantica	2		Mt. Atlas Pistache
T,cl	Asia	Pistacia chinensis	3		Chinese Pistache
T,cl		Pistacia terebinthus x integerrima	3		Pistache hybrid terebinthus x integerrima
T	Asia	Pistacia vera	2-3		Pistachio
T	CD	Pithecellobium flexicaule	2	(sh)	Texas Ebony
T	SD	Pithecellobium mexicanum	3		Mexican Ebony
T	CD	Pithecellobium pallens	2	(sh)	Tenaza
T	Austr.	Pittosporum phillyraeoides	2		Willow Pittosporum
an	SD,CD	Plantago spp.	1-2		Indian Wheat
T#	S. Am.	Prosopis (So. Am. hybrid)	2		Thornless Mesquite (So. Am. hybrid)
T#	S. Am.	Prosopis alba	2		Argentine Mesquite
T#	S. Am.	Prosopis chilensis	2		Chilean Mesquite
T#	CD	Prosopis glandulosa glandulosa	2		Honey or Texas Mesquite
T	SD,CD	Prosopis pubescens	2		Screwbean Mesquite
T#	SD	Prosopis velutina	2		Velvet Mesquite
p,cl	SD,CD	Psilostrophe cooperi	2		Paper Flower
S,T,cl	India	Punica granatum	2-3		Pomegranate
S,cl		Pyracantha (red berried types)	3		Pyracantha (many cultivars)
T	SD,CD	Quercus arizonica	3		Arizona White Oak

APPENDIX 5B *(continued)*
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

Plant Type Category	Region	Low Water Use/ Drought Tolerant Plant List	Watering Needs		
T,cl	W.Tx.	Quercus buckleyi	2-3		Texas Red Oak
T	SD,CD	Quercus emoryi	3		Emory Oak
T		Quercus ilex	3		Holly Oak
T*	Medit.	Quercus suber	2		Cork Oak
S	W.U.S.	Quercus turbinella	2-3		Shrub Live Oak
T	SEU.S.	Quercus virginiana	3		Southern Live Oak
T,I	Africa	Rhus lancea	2		African Sumac
S,cl	CD	Rhus microphylla	2		Littleleaf Sumac
S	SD	Rhus ovata	2		Sugar Bush, Sugar Sumac
S,cl	CD	Rhus virens	2		Evergreen Sumac
S,Gc,V		Rosa banksiae	3		Lady Banks Rose,Tombstone Rose
S,cl	Medit.	Rosmarinus officinalis	2-3		Bush Rosemary
S,cl	SD	Ruellia californica	3	(t)	Ruellia
S,cl	SD	Ruellia peninsularis	3	(t)	Ruellia
Sc,Gc		Ruschia uncinatus	2		Ruschia
S,p,cl	CD	Salvia chamaedryoides	2-3		Blue Sage
S,cl		Salvia clevelandii	3		Cleveland Sage
an,cl	SD	Salvia columbariae	3		Chia
S,cl	CD	Salvia farinacea	3-4		Mealy Cup Sage
S,cl	CD	Salvia greggii	2-3		Texas Red Salvia,Autumn Sage
S,cl	SD	Salvia mohavensis	2		Mohave Sage
T	SD,CD	Sambucus mexicana	2		Mexican Elderberry
S,Gc	Medit.	Santolina chamaecyparissus	2-3		Lavender Cotton
Gc,S,cl	Medit.	Santolina virens	3-4		Green Santolina
T*	SD,CD	Sapindus saponaria	3-4		Soapberry
T	S.Am.	Schinus molle	2-3		California Pepper Tree
p,cl*		Senecio cineraria	3		Dusty Miller,Silver Plant
p,cl	SD	Senna covesii	1-2		Desert Senna
S	CD	Senna lindheimeriana	4	(sh)	Senna
S,p,cl	SD,CD	Senna wislizenii	2		Cassia,Shrubby Senna
Gc	Africa	Sesuvium verrucosum	2	(t)	Sea Purslane,Ice Plant
Gr	SD,CD	Setaria macrostachya	3		Plains Bristle Grass
S	SD	Simmondsia chinensis	1-2		Jojoba,Goat Nut
S,T,cl*	CD	Sophora secundiflora	2-3		Mescal Bean,Texas Mountain Laurel
p,cl	SD,CD	Sphaeralcea spp.	1		Globe-Mallow
Gr	SD,CD	Sporobolus airoides	3		Alkali Sacaton
Gr	SD,CD	Sporobolus contractus	1		Spike Dropseed
Gr	SD,CD	Sporobolus cryptandrus	3		Sand Dropseed
Gr	SD,CD	Sporobolus flexuosus	2		Mesa Dropseed
Gr	SD,CD	Sporobolus wrightii	1		Sacaton

APPENDIX 5B *(continued)*
LOW WATER USE/DROUGHT TOLERANT PLANT LIST
SANTA CRUZ ACTIVE MANAGEMENT AREA

Plant Type Category	Region	Low Water Use/ Drought Tolerant Plant List	Watering Needs		
C	SD	Stenocereus (Lemaireocereus) thurberi	1	(t)	Organ Pipe Cactus
Gr	SD,CD	Stipa neomexicana	2		New Mexicofeathergrass
p,cl	SD	Tagetes lemmoni	3-4		Mountain Marigold
T	Asia	Tamarix aphylla	1		Athel Tree,Tamarisk
S,cl	SD,CD	Tecoma stans var. angustata	2-3	(sh)	Trumpet-Bush
S,cl	Africa	Tecomaria capensis	4	(sh)	Cape Honeysuckle
Gc,p	Medit.	Teucrium chamaedrys (prostratum)	2-3		Prostrate Germander
S		Teucrium fruticans	3		Bush Germander
Gr	SD,CD	Trichloris crinita	2		Two-feather trichloris
C		Trichocereus spp.	1-2		Trichocereus Cactus
Gr	SD,CD	Tridens muticus	2		Slim tridens
T,cl	CD	Ungnadia speciosa	3		Mexican Buckeye
S,T#	SD	Vauquelinia californica	2		Arizona Rosewood
p,cl	SD	Verbena gooddingii	3-4		Goodding Verbena
p,cl	S.Am.	Verbena peruviana	4		Peruvian Verbena
p,cl	S.Am.	Verbena tenuisecta(pulchella)	3		Moss Verbena,Fineleaf Verbena
an,cl	SD,CD	Verbesina encelioides	2		Crown Beard
p,cl	SD	Viguiera deltoidea	2		Golden Eye
T,S,cl		Vitex agnus-castus	2		Chaste Tree,Monk's Pepper
T	SD	Washingtonia filifera	2		California Fan Palm
T	SD	Washingtonia robusta	2-3	(sh)	Mexican Fan Palm
T,S	China	Xylosma congestum	3-4		Xylosma
A	SD	Yucca aloifolia	1		Spanish Bayonet Yucca
A	SD,CD	Yucca baccata	1		Banana Yucca
A	CD	Yucca brevifolia	1		Joshua Tree
A	CD	Yucca carnerosana	1		Giant Dagger Yucca
A	SD,CD	Yucca elata	1		Soaptree Yucca
Sc	U.S.	Yucca glauca	1		Small Soapweed Yucca
A	U.S.	Yucca recurvifolia(pendula)	2		Pendulous or Curveleaf Yucca
A,cl	CD	Yucca rigida	1		Blue Dagger Yucca
A	CD	Yucca rostrata	1		Beaked Yucca
Sc	SD	Yucca schottii	1		Mountain Yucca
A	CD	Yucca treculeana	1		Tree Yucca
A	SD	Yucca whipplei	1		Our Lord's Candle
Gc,cl	SD	Zauschneria californica	3		Hummingbird Trumpet
S,cl	SWUS	Zexmenia hispida	2-3	(sh)	Rough Zexmenia
p,cl	SD,CD	Zinnia acerosa	1		Desert Zinnia
p,cl	CD	Zinnia grandiflora	2		Rocky Mountain Zinnia
T,I	Asia	Zizyphus jujuba	2		Chinese Date

APPENDIX 5C.1
TOTAL GPCD CONSERVATION PROGRAM
CONSERVATION REQUIREMENT CALCULATION
SANTA CRUZ ACTIVE MANAGEMENT AREA

A. Residential:

1. Existing Residential Allotment

   a. Determine the population in single family housing units as of July 1, 2000,
   Determine the population in multifamily housing units as of July 1, 2000,
   Add the SF and MF Population to determine Year 2000 Residential Population;

   b. Multiply the year 2000 residential population by the provider's existing residential GPCD component (Table 5-5), multiply this number by 365 days and divide the product by 325,851;

   c. The result is the annual volumetric allotment, in acre-feet, for existing residential uses. Reasonable reductions in GPCD are included in the annual target calculation.

2. New Single Family and Multifamily Residential Allotment:

   a. Determine the new single family housing units added since July 1, 2000,
   Determine the new single family population (post-7/1/00) for the calendar year,
   Determine the new multifamily housing units added since July 1, 2000,
   Determine the new multifamily population (post-7/1/00) for the calendar year;

   b. Multiply the new single family population by the interior rate for new single family residential development, 57 GPCD, then multiply the result by 365 days and divide the product by 325,851;

   c. Multiply the new single family housing units by the exterior rates for new single family residential development, 107 GPHUD, then multiply the result by 365 days and divide the product by 325,851;

   d. Multiply the new multifamily population by the rate for new multifamily residential development, 57 GPCD, then multiply the result by 365 days and divide the product by 325,851;

   e. Multiply the new multifamily housing units by the exterior rates for new single family residential development, 26 GPHUD, then multiply the result by 365 days and divide the product by 325,851;

   f. The sum of the results of paragraphs b, c and d is the annual volumetric allotment, in acre-feet, for new residential uses.

3. Add the existing residential allotment and the new residential allotment. The sum is the TOTAL RESIDENTIAL ALLOTMENT for the calendar year.

APPENDIX 5C.1 *(continued)*
TOTAL GPCD CONSERVATION PROGRAM
CONSERVATION REQUIREMENT CALCULATION
SANTA CRUZ ACTIVE MANAGEMENT AREA

B. Non-Residential:

1. Multiply the total population for the calendar year by the provider's non-residential GPCD component from Table 5-5, multiply the result by 365 days and divide the product by 325,851;

2. The result is the volumetric allotment, in acre-feet, for non-residential uses for the calendar year.

C. Turf-Related Facilities:

The turf-related facilities component is the sum of the maximum annual water allotments, in acre-feet, for the turf-related facilities assigned to the provider in Appendix 5G. The allotment for a turf-related facility is included only if the facility is served water from any source by the provider during the calendar year.

D. Lost and Unaccounted For Water (LUW):

1. Subtract the total amount of water served during the calendar year for residential, non-residential, turf-related facilities, and system-related uses from the total amount of water withdrawn, received, diverted and recovered during the calendar year. The remainder is the LUW volume.

2. Divide the LUW volume by the total amount of water withdrawn, received, diverted and recovered for the calendar year.

3a. If the product is **less than or equal to** 10 percent, the volume of lost and unaccounted for water from D.1 is the volumetric allotment, in acre-feet, for the calendar year.

3b. If the product is **greater than** 10 percent, multiply the total amount of water withdrawn, received, diverted and recovered for the calendar year by 10 percent. The product is the volumetric allotment, in acre-feet, for lost and unaccounted for water for the calendar year.

APPENDIX 5C.2
TOTAL GPCD CONSERVATION PROGRAM
CONSERVATION REQUIREMENT CALCULATION EXAMPLE
SANTA CRUZ ACTIVE MANAGEMENT AREA

Example: The existing population is comprised of the occupants of housing units being served by the water provider as of July 1, 2000. The new population is comprised of occupants of housing units added to the provider's service area after July 1, 2000.

1)		EXISTING HOUSING UNITS/POPULATION		
	a.	Existing (7/1/00) SF Housing Units	=	3,000
	b.	Existing (7/1/00) MF Housing Units	=	800
	c.	**TOTAL EXISTING RESIDENTIAL HOUSING UNITS**	**=**	**3,800**
	d.	Existing (7/1/00) SF Population	=	9,000
	e.	Existing (7/1/00) MF Population	=	2,800
	f.	**TOTAL EXISTING RESIDENTIAL POPULATION**	**=**	**11,800**
2)		NEW HOUSING UNITS/POPULATION		
	a.	New SF Housing Units Added after July 1, 2000	=	100
	b.	New MF Housing Units Added after July 1, 2000	=	35
	c.	**TOTAL NEW RESIDENTIAL HOUSING UNITS**	**=**	**140**
	d.	New SF Population Added since July 1, 2000	=	300
	e.	New MF Population Added since July 1, 2000	=	123
	f.	**TOTAL NEW RESIDENTIAL POPULATION**	**=**	**423**
3)		COMPONENT RATES		
	a.	Existing Residential GPCD Component	=	115 (1)
	b.	New Residential SF Interior GPCD Component	=	57 (2)
	c.	New Residential SF Exterior GPHUD Component	=	107 (2)
	d.	New Residential MF Residential GPCD Component	=	57 (2)
	e.	New Residential MF Exterior GPHUD Component	=	26
	e.	Non-Residential GPCD Component	=	32 (3)
4)		COMPONENT ALLOTMENTS IN ACRE-FEET		
	a.	Existing Residential = 11,800 people x 115 GPCD x 365 / 325851	=	1,520 AF/YR
	b.	New SF Interior = 300 people x 57 GPCD x 365 / 325851	=	19 AF/YR
	c.	New SF Exterior = 100 housing units x 107 GPHUD x 365 / 325851	=	12 AF/YR
	d.	New MF Residential = 123 people x 57 GPCD x 365 / 325851	=	8 AF/YR
	e.	New MF Exterior = 35 housing units x 26 GPHUD x 365/325851	=	1 AF/YR
	f.	**Residential Allotment**	**=**	**1,560 AF/YR**
	g.	Non-Residential = 12,223 people x 32 GPCD x 365 / 325851	=	438 AF/YR
	h.	**Non-residential Allotment**	**=**	**438 AF/YR**
	i.	**Turf-related Facility = the MAWA for one 18-hole golf course**	**=**	**428 AF/YR**
	j.	Lost/Unaccounted Water Component @ 10% of total annual use	=	270 (4) AF
	k.	**Lost/unaccounted For Allotment**	**=**	**270 AF**
	l.	**TOTAL ALLOTMENT = Res. + Non-Res. + Turf + LUW**	**=**	**2,696 AF**

APPENDIX 5C.2 *(continued)*
TOTAL GPCD CONSERVATION PROGRAM
CONSERVATION REQUIREMENT CALCULATION EXAMPLE
SANTA CRUZ ACTIVE MANAGEMENT AREA

5) ANNUAL TOTAL GALLONS PER CAPITA PER DAY REQUIREMENT

Total GPCD Requirement = 2,696 AF x 325,851 / 12,223 / 365 = **197 GPCD**

(1) The existing GPCD components are listed in Table 5-5 for each large provider. The number given here is for example purposes only.

(2) The New Single Family and Multifamily Interior and Single Family and Multifamily Exterior GPHUD components are based on the requirements for the Santa Cruz AMA. See Appendices 5E and 5F.

(3) Non-Residential GPCD Components are listed in Table 5-5. For providers assigned a non-residential component less than 21 GPCD, the non-residential component may increase up to 21 GPCD during any calendar year.

(4) The Lost and Unaccounted for Water component may vary in any calendar year. The component will equal the amount of lost and unaccounted for water for the calendar year, not to exceed 10%.

APPENDIX 5D
BASE PERIOD (1992-1995) WATER USE DATA FOR LARGE MUNICIPAL PROVIDER
SANTA CRUZ ACTIVE MANAGEMENT AREA

Provider	Single Family Residential Use (GPCD)	Multifamily Residential Use (GPCD)	Non-Residential Use (GPCD)	Turf-Related (AF/YR)	Lost Water (%)
Citizens' Water Resources	N/A	N/A	34[1]	N/A	13
City of Nogales	116	61	46	866.4	11
Rio Rico Utilities	N/A	N/A	39	N/A	11
Valle Verde Water Co.	77	71	11[1]	N/A	10

[1] 1985 non-residential GPCD (1992-1995 average is higher than the 1985 and disproportionate increases in the non-residential GPCD rate are not adjusted for under the Total GPCD Program.

APPENDIX 5E
INTERIOR WATER USE MODEL FOR NEW RESIDENTIAL DEVELOPMENT
SINGLE FAMILY HOUSING UNITS
SANTA CRUZ ACTIVE MANAGEMENT AREA

1. 1.7 g/flush Toilet[1]

A. 4.5 flush per day national average[2]
B. Adjusted to 5 flushes per day to reflect higher retiree population in AZ.
C. Average flush for ULF toilets 1.7 gallons[2]
D. *Calculation:*

1.7 gallons/flush * 5 flushes per person per day = **8.5 GPCD**

2. 2.5 gpm Showerhead[1]

A. 7.9 minutes per shower national average[2]
B. 0.9 shower per person per day[3]
C. 2.5 gallons per minute
D. *Calculation:*

7.9 minutes per shower * 2.5 gallons per minute * 0.9 shower per day = **17.8 GPCD**

3. Low Water Use Dishwasher

A. 9.81 gallons per cycle[4]
B. 0.18 cycle per person per day[2]
C. *Calculation:*

9.81 gallons per cycle * 0.18 cycle per person per day = **1.8 GPCD**

4. Low Water Use Clotheswasher

A. 30.25 gallons per cycle[4]
B. 0.30 cycle per person per day[2]
C. *Calculation:*

30.25 gallons per cycle * 0.30 cycle per person per day = **9.1 GPCD**

5. Bathtub

A. 32.5 gallons average bathtub volume at maximum fill.
B. Use/person/day set at 0.1 to allow 1 bathing event/person/day: 0.9 shower/person/day + 0.1 bath/person/day = 1.0 bathing event/person/day.
C. *Calculation:*

32.5 gallons per bath *0.1 bath per person per day = **3.3 GPCD**

6. 2.5 gpm Faucets

A. 10 GPCD national average faucet use[5]
B. 2.5 gallons per minute
C. *Calculation:*

4.0 minutes per person per day * 2.5 gallons per minute = **10.0 GPCD**

1 A.R.S. § 45-312.
2 Mayer, P., DeOreo, W., Nelson, J., Opiz, E. & allen, B., "North American Residential End Use Study Progress Report," Proceedings of 1997 American Water Works Association Annual Conference, AWWA, 1997.
3 City of Mesa and Logan, Simpson & Dye, "Final Paper: Multi-Family Exterior/Interior Water Use Efficiency Evaluation," October, 1996.
4 Data from ADWR Phoenix AMA, Phoenix Area survey March 1997 average water consumption by 3 models most often installed in hew housing.
5 Data from John O. Nelson Water Resources management for AWWA WaterWiser™ (www.waterwiser.org), after Mayer, et. al., AWWA, 1997.

7. Miscellaneous[5]

A. Average leak and unidentified flow trace volume = **6.6 GPCD**

New Residential Interior Water Use Model Summary

Toilet	8.5 GPCD
Shower	17.8 GPCD
Dishwasher	1.8 GPCD
Clotheswasher	9.1 GPCD
Bathtub	3.3 GPCD
Faucets	10.0 GPCD
Miscellaneous	6.6 GPCD
	57.1 GPCD

[5] Data from John O. Nelson Water Resources management for AWWA WaterWiser™ (www.waterwiser.org), after Mayer, et. al., AWWA, 1997.

APPENDIX 5F.1
EXTERIOR WATER USE MODEL FOR NEW RESIDENTIAL DEVELOPMENT
SINGLE FAMILY HOUSING UNITS
SANTA CRUZ ACTIVE MANAGEMENT AREA

SWIMMING POOLS

Average Water Consumption

1. Evaporation[1]
   A. Average Evapotranspiration (ETo) = 64.29 inches/yr
   B. Average Rainfall = 18.63 inches/yr
   C. *Calculation:*
      64.29 in/yr ETo - 18.63 in/yr rainfall = 45.66 in/yr
      45.66 inches per year / 12 feet per inch = 3.81 ft/yr
      400 square feet * 3.81 ft/yr * 7.48 gal/cubic foot = **11,385 gallons/year**

2. Backwash[2]
   A. Recommended backwash 2 to 4 minutes 23 times a year at 75 to 85 gallons per minute
   B. *Calculation:*
      2 minutes * 75 gpm * 23 times/year = **3,450 gallons/year**

3. Maintenance Refill[2]
   A. Average pool size is 400 square feet of surface by 5 feet deep
   B. Allow for a refill once every ten years - ADWR assumption
   C. *Calculation:*
      400 * 5 = 2,000 * 7.48 = 14,960 gallons per new pool
      14,960 gallons / 10 years = **1,496 gallons/year**

4. Initial Fill
   A. Average pool size is 400 square feet of surface by 5 feet deep
   B. *Calculation:*
      400 * 5 = 2,000 * 7.48 = **14,960 gallons**

5. Total Annual Demand
   A. Total Demand for Pool:

Evaporation	11,385 gallons/year
Backwash	3,450 gallons/year
Initial Fill	14,960 gallons/year
Maintenance Refill	1,496 gallons/year
	31,291 gallons/year

   B. Savings From Pool cover:[1]
      1) Average Oct. - Apr. Reference Evapotranspiration (ETo) = 27.42 inches/yr
      2) Average Oct. - Apr. Rainfall = 7.17 inches/yr
      3) *Calculation:*
         27.42 in/yr ETo - 7.17 in/yr rainfall = 20.25 in/yr
         20.25 inches per year / 12 feet per inch = 1.69 ft/yr
         400 square feet * 1.69 ft/yr * 7.48 gal/cubic foot = **5,056 gallons per year**

[1] ETo and rainfall from Arizona Meteorological Network, Nogales Station, 1964-1983, (www.ag.arizona.edu/AZMET)
[2] Data from National Spa and Pool Institute, ADWR Phoenix AMA telephone interview, December, 1995.

EXTERIOR WATER USE MODEL FOR NEW RESIDENTIAL DEVELOPMENT
SINGLE FAMILY HOUSING UNITS
SANTA CRUZ ACTIVE MANAGEMENT AREA

Installation Rates[3]

A. 10% of new housing will install a pool.
B. 1% of new housing install a pool per year.
C. 59.22% of pool owners use a pool cover from October through April.
D. *Calculation:*

Evaporation - 11,385 gallons/year * 10%	=	1,139 gallons/year
Backwash - 3,450 gallons/year * 10%	=	345 gallons/year
Initial Fill - 14,960 gallons/year / 10 years * 10%	=	150 gallons/year
Maintenance Refill - 1,496 gallons/year * 10%	=	150 gallons/year
		1,784 gallons/year
Cover 5,056 gallons/year * 59.22% * 10%	=	- 299 gallons/year
		1,485 gallons/year

Demand per Housing Unit per Day

1,485 gallons/year / 365 days/year = **4.07 GPHUD**

[3] Abernathy, Steven, data from exterior water use survey of single family residential housing built 1990-1998, for ADWR, 1998.

APPENDIX 5F.2
EXTERIOR WATER USE MODEL FOR NEW RESIDENTIAL DEVELOPMENT
SINGLE FAMILY HOUSING UNITS
SANTA CRUZ ACTIVE MANAGEMENT AREA

EVAPORATIVE COOLERS

Average Water Consumption[5]

1. Average water consumption per cooling season for evaporative coolers with a bleed-off system is 23,248 gallons (2,906 cooling hours per season @ 8 gallons per hour).
2. Average water consumption per cooling season for evaporative coolers without a bleed-off system is 11,624 gallons (2,906 cooling hours per season @ 4 gallons per hour).
3. 40.98% of coolers utilize a bleed-off system.
4. 59.02% of coolers do not utilize a bleed-off system.
5. *Calculation:*

23,248 * 59.02	=	13,721 gallons
11,624 * 40.98%	=	4,764 gallons
		18,485 gallons

Installation Rates[3]

1. 3.99% of respondents to survey of housing units built 1992-1995 in Tucson Water and Metro Water District service areas have only evaporative cooling.
2. 10.70% have both evaporative and refrigeration cooling.
3. Dual system households average cooling hours per season 59.52% of cooler only households cooling hours
4. *Calculation:*

18,485 gallons/year * 3.89%	=	719 gallons/year
18,485 gallons/year * 10.42% * 59.52%	=	1,146 gallons/year
		1,865 gallons/year

Demand per Housing Unit per Day
1,865 gallons/year / 365 days/year = **5.11 GPHUD**

5 Data from Karpiscak, M., Babcock, T., France, G., Zauderer, J., Hopf, S. And Foster, K., "Evaporaive Cooler Water Use In Phoenix", Journal, Vol. 90, Issue 4 (April, 1998), American Water Works Association.

APPENDIX 5F.3
EXTERIOR WATER USE MODEL FOR NEW RESIDENTIAL DEVELOPMENT
SINGLE FAMILY HOUSING UNITS
SANTA CRUZ ACTIVE MANAGEMENT AREA

LANDSCAPING

Average Water Consumption

1. Turf
   A. Turf area observed for housing units built 1992-1995 is approximately 600 square feet[3]
   B. Water application at 60% of average annual reference evapotranspiration (64.29 inches)[1]
   C. Effective rainfall at 50% of annual average (18.63 inches)[1]
   D. Irrigation efficiency for residential sprinkler systems at 75%
   E. *Calculation:*

      64.29 inches * 60% = 38.57 inches
      18.63 inches * 50% = 9.32 inches
      38.57 inches - 9.32 inches = 29.26/ 12 = 2.4 feet * 600 sq.ft. = 1,463 cu.ft.
      1,463 cu.ft * 7.48 = 10,943 gallons / 75% = **14,590 gallons**

2. Garden
   A. Garden area observed for housing units built 1992-1995 is approximately 200 square feet [3]
   B. Water application at 70% of average annual reference evapotranspiration (64.29 inches)[1]
   C. Effective rainfall at 10% of annual average (18.63 inches)[1]
   D. Irrigation efficiency for basin or soaker hose watering at 70%
   E. *Calculation:*

      64.29 inches * 70% = 45.0 inches
      18.63 inches * 10% = 1.86 inches
      45.0 inches - 1.86 inches = 432.141 / 12 = 3.60 feet * 200 sq.ft. = 719 cu.ft.
      719 cu.ft * 7.48 = 5,378 gallons / 70% = **7,683 gallons**

3. Trees
   A. Number of trees observed for housing units built 1992-1995 is approximately 8 low water use species and 2 high water use trees.[3]
   B. Water application (% of average reference evapotranspiration)[1,6]
      1) Low water use species = 19.5%
      2) High water use species = 58.0%
   C. Reference Evapotranspiration[1,6]
      1) LWU deciduous species, April - September average, 43.59 inches
      2) HWU deciduous species, April - October average, 48.35
   D. 14 foot average canopy diameter at maturity = water demand at 96 gallons/inch of ETtree [6]
   E. Effective rainfall at 10% of annual average (18.63 inches), Apr.-Sep. average (11.85 inches)[1]
   F. Irrigation efficiency = 70%[7]
   G. *Calculation:*

      48.35 inches * 58.0% = 28.04 inches
      43.59 inches * 19.5% = 8.50 inches
      18.63 inches * 10% = 1.86 inches, 11.85 inches * 10% = 1.19 inches
      28.04 - 1.19 = 26.85 * 96 = 2,577.6 gallons * 2 = 5,155 gallons
      8.50 - 1.19 = 7.31 * 96 = 701.76 gallons * 8 = 5,614 gallons
      5,155 + 5,614 gallons / 70% = **15,384.4 gallons**

APPENDIX 5F.3 *(continued)*
EXTERIOR WATER USE MODEL FOR NEW RESIDENTIAL DEVELOPMENT
SINGLE FAMILY HOUSING UNITS
SANTA CRUZ ACTIVE MANAGEMENT AREA

LANDSCAPING

4. Shrubs, accents, groundcover, vines
   A. Number of plants observed for housing units built 1992-1995 is 11 low water use species and 11 medium water use species.[3]
   B. Water application (% of average annual reference evapotranspiration, 64.29 inches)[1,6]
      1) Low water use species = 19.5%
      2) Medium water use species = 35.5%
   C. 4 foot average canopy diameter at maturity = water demand at 8 gallons/inch of ETplant[6]
   D. Effective rainfall at 10% of annual average (18.63 inches)
   E. Irrigation efficiency =70%[7]
   F. *Calculation:*

      64.29 inches * 19.5% = 12.54 inches
      64.29 inches * 35.5% = 22.82 inches
      18.63 inches * 10% = 1.86 inches
      12.54 - 1.86 = 10.68 * 8 = 85.44 gallons * 11 shrubs = 939.84 gallons
      22.82 - 1.86 = 20.96 * 8 = 167.68 gallons * 11 shrubs = 1,844.48 gallons
      939.82 + 1,844.48 gallons / 70% = **3,977.57 gallons**

Installation Rates[3]
A preliminary landscape survey of recently constructed homes in Nogales and Rio Rico found most new homes had some turf, usually in the back yard, and most included a rather large vegetable garden, some trees and several shrubs. A general assumption that 80% of new homes will have turf, 65% will have a substantial garden, and all will have trees and shrubs has been made. These assumptions result in a model that provides adequate water to maintain an attractive landscape, given evapotranspiration and precipitation conditions common to the Santa Cruz basin.

Calculation:

14,590 gallons/year * 80%	=	11,672 gallons/year
7,683 gallons/year * 65%	=	4,994 gallons/year
15,384 gallons/year * 100%	=	15,384gallons/year
3,978 gallons/year * 100%	=	3,978 gallons/year
		36,028 gallons/year

Demand per Housing Unit per Day
36,028 gallons/year / 365 days/year = **98.7 GPHUD**

6 Pima County Cooperative Extension Service, Low4 Program, Landscape Water Conservation Workshop materials: "How to Develop a Drip Irigation Schedule" and "Plant Water Requirements Tucson, Arizona", unpublished.

7 "Landscape Water Management Principles", Irrigation Training and Research Center, California Polytechnic State University, San Luis Obispo, undated.

APPENDIX 5G
TOTAL GPCD CONSERVATION PROGRAM
TURF-RELATED FACILITIES SERVED GROUNDWATER BY MUNICIPAL PROVIDERS AS OF JANUARY 1, 1990 AND MAXIMUM ANNUAL WATER ALLOTMENTS
SANTA CRUZ ACTIVE MANAGEMENT AREA

Water Provider - Turf-Related Facility	Allotment (acre-feet)
City of Nogales	
Kino Springs Golf Course	488.6
Palo Duro Golf Course	371.4
TOTAL FOR CITY OF NOGALES	**860.0**

APPENDIX 5H.1

RESIDENTIAL INTERIOR AND EXTERIOR STANDARD REASONABLE CONSERVATION MEASURES

RESIDENTIAL INTERIOR
STANDARD RCM

ORDINANCE OR CONDITION OF NEW SERVICE PROHIBITING INSTALLATION OR REPLACEMENT OF PLUMBING FIXTURES IN RESIDENTIAL HOUSING UNITS UNLESS FIXTURES MEET WATER SAVING STANDARDS

Description: *The provider adopts an ordinance or establishes conditions of new service prohibiting the installation of plumbing fixtures in new residential housing units and the replacement of plumbing fixtures in existing residential housing units unless the fixtures meet water efficiency standards. Plumbing fixtures to be covered and their respective maximum use rates are as follows:*

- *Faucets-kitchen and lavatory* — *3.0 gpm*
- *Replacement aerators - kitchen and lavatory* — *3.0 gpm*
- *Metering faucets* — *.25 gpc*
- *Toilets* — *1.6 gpf*
- *Showerheads* — *3.0 gpm*
- *Evaporative cooling systems/Decorative fountains must be equipped with water recycling or reuse systems*

Waivers may be available for unusual circumstances (e.g., historic buildings or areas where sanitation or health codes may conflict).

Implementation: *The provider shall adopt and enforce a plumbing ordinance or establish conditions of new service prohibiting the installation of plumbing fixtures in new housing units and the replacement of plumbing fixtures in existing housing units unless the fixtures meet the water savings performance standards outlined in the description above. Implementation of this RCM shall include a proactive inspection and enforcement program which ensures compliance with the applicable ordinance or conditions of service.*

Monitoring/Reporting: *The annual report required by A.R.S. § 45-632 shall include a copy of the current local plumbing ordinance or sample conditions of new service agreement which meet the implementation requirements for this RCM. This shall be submitted one time only (the first year of compliance with the Non-Per Capita Conservation Program) unless there is an amendment to the ordinance or agreement.*

In addition, the provider shall include in the annual report evidence of implementation of the applicable ordinance or conditions of service by reporting the number of certificates of occupancy issued in the service area, the number of permits issued for the replacement of plumbing fixtures in existing housing units, the number of housing units inspected, the number and type of plumbing fixture violations and any enforcement action taken.

A provider that is not a city or town shall also collect and examine all inspection records for new permits issued by governmental entities for the installation of original plumbing fixtures in new housing units and the replacement of plumbing fixtures in existing housing units within the provider's service area and report any plumbing code or plumbing ordinance violations that have not been enforced to the governing body of the entity charged with enforcing the code or ordinance.

Note: This documentation will be used to evaluate the effectiveness of the RCM. It will not be used to require any modification of the negotiated Non-Per Capita Conservation Program agreement.

RESIDENTIAL INTERIOR
STANDARD RCM

WATER AUDIT AND FIXTURE RETROFIT PROGRAM FOR EXISTING RESIDENTIAL CUSTOMERS
Description: *Water provider staff or hired consultants visit residences, or resident performs self-audit, to examine water use practices, detect leaks, make recommendations for improved efficiency and install retrofit devices. Water use reduction from installation of devices depends on the life of the device, for example toilet flapper normally last about five years.*
Implementation Levels: *Minimum Conservation Potential: The provider shall notify all existing residential customers of the availability of a self-audit and retrofit kit. The provider shall distribute a kit to all customers who request one. Moderate Conservation Potential: The provider shall perform minimum level requirement, plus a minimum of 10 percent of all pre-1980 housing units shall be audited and retrofitted, free of charge to the customer, by January 1, 2010 either by the homeowner or by a trained auditor. Maximum Conservation Potential: The provider shall perform minimum level requirement, plus a minimum of 20 percent of all pre-1980 housing units shall be audited and retrofitted, free of charge to the customer, by January 1, 2010 either by the homeowner or by a trained auditor.* *The self-audit and retrofit kit shall include, at a minimum, toilet leak detection dye tabs, instructions on measuring flow from fixtures, leak repair and fixture replacement instructions, advice on behavioral changes to save water, a toilet conservation device, a low flow showerhead and faucet aerators. The audit shall include measurement of flow rates from plumbing fixtures and a check for leaks.* *The housing units audited or retrofitted to meet this requirement shall not include any housing unit that was audited or retrofitted prior to acceptance into this program for the third management period unless the water use of the housing unit is inefficient.*
Monitoring and Reporting Requirements: *The Annual Report required by A.R.S. § 45-632 shall include a report containing information as agreed to at the time of acceptance into the Non-Per Capita Conservation Program sufficient to assess program effectiveness, including information on the method(s) used to contact customers, the annual number of audits and retrofits performed and self-audit kits sent out, and an estimate of the number and volume of leaks found and repaired.*

RESIDENTIAL EXTERIOR
STANDARD RCM

AUDIT PROGRAM FOR EXISTING RESIDENTIAL CUSTOMERS

Description: *Trained auditors visit residences to examine outdoor water use practices, or materials are supplied for a self-audit of outdoor water use practices. Areas of emphasis are irrigation scheduling advice, sprinkler and drip systems inspection, evaporative cooler inspection, information on improving water retaining capacity of the soil, information on Xeriscape™ concepts and swimming pool maintenance and evaporation control (i.e., pool covers). This program shall be designed to target those customers with the greatest conservation potential.*

Implementation Levels: *Minimum Conservation Potential: The provider shall notify all existing residential customers of the availability of an exterior water use self-audit packet. The packet shall include at a minimum information on checking irrigation systems for efficiency and leaks, information on checking evaporative coolers for efficiency and leaks, irrigation schedules, and information on Xeriscape™. The provider shall distribute a packet to all customers who request one. Moderate Conservation Potential: The provider shall implement the minimum level program plus 5 percent of total housing units in existence when the provider is accepted into this program shall be audited either by the homeowner or a trained auditor free of charge to the customer. Audits shall be completed by January 1, 2010. Maximum Conservation Potential: The provider shall implement the minimum level program plus 10 percent of total housing units in existence when the provider is accepted into this program shall be audited either by the homeowner or a trained auditor free of charge to the customer. The audits shall be completed by January 1, 2010.*

For both the moderate and maximum levels of implementation, the ratio of audited multifamily housing units to audited single family housing units shall be no greater than the ratio of total multifamily housing units to total single family housing units in the entire service area.

The housing units audited to meet this requirement shall not include any housing unit that was audited prior to acceptance into this program for the third management period unless the water use of the housing unit is inefficient.

Monitoring and Reporting Requirements: *The Annual Report required by A.R.S. § 45-632 shall include a report on the number of housing units audited, plus a follow-up survey of a statistically significant sample of those audited, as agreed to by the director, to determine if audited customers have implemented any changes in exterior use habits, irrigation system, or landscaping.*

RESIDENTIAL EXTERIOR
STANDARD RCM

LANDSCAPE WATERING ADVICE PROGRAM FOR EXISTING AND NEW RESIDENTIAL CUSTOMERS

Description: *Landscape watering advice helps existing and new homeowners to irrigate efficiently. The components of a landscape watering advice program may include guidelines for irrigation scheduling based on time of day or season and dissemination of weather-based watering information (e.g: ET rate based on solar radiation, temperature, rainfall and relative humidity). Programs which encourage watering only every other day and only at certain times of day have also been shown to save water.*

Implementation Levels: *Minimum Conservation Potential: The provider shall notify all existing and new residential customers of the availability of information from the provider regarding the general benefits of efficient landscape watering including water and cost savings. This notification shall be through water bill inserts printed directly on bills in a prominent manner, or some other mechanism approved by the director. The provider shall distribute the landscape watering information to all customers who request it. Moderate Conservation Potential: The provider shall mail the landscape watering information to all existing and new residential customers or make it available to the customers at local distribution centers such as schools, libraries, plant nurseries, or model homes and notify all residential customers of the location of the information. Maximum Conservation Potential: The provider shall implement the moderate level programs plus hold workshops on landscape irrigation and/or have a landscape advisor available for telephone advice to customers and/or develop a conservation goal-billing program designed to assist residential customers to determine the requirements for landscape water use. The provider shall hold at least one workshop annually for every 100,000 persons in the provider's service area. If there are less than 100,000 persons, the provider shall hold one workshop annually. If the telephone advice option is chosen, the provider shall publicize the telephone number at least once quarterly.*

Monitoring and Reporting Requirements: *The Annual Report required by A.R.S. § 45-632 shall include a report on the methods used to contact customers, the number of pamphlets/brochures distributed, the number of workshops conducted, and the number of phone calls taken to give landscape irrigation advice.*

RESIDENTIAL EXTERIOR
STANDARD RCM

ORDINANCE OR CONDITION OF NEW SERVICE FOR MODEL HOMES IN NEW RESIDENTIAL DEVELOPMENTS
Description: *Model homes in new developments are required to use low water use landscaping in front yards to set the tone for landscaping by homeowners. This measure helps to educate home buyers about the possibilities of appropriate landscaping for the area. Provision of information on low water use landscaping and/or landscape packages offered to new home buyers reinforces the message.*
Implementation: *The provider shall adopt and enforce an ordinance or establish conditions of new service requiring that new model homes meet water efficient standards. These include limitation of water-intensive landscaping to 10 percent of landscapable area, location of such landscaping where it is functionally useful, use of low water use plants from the Department's Low Water Use/Drought Tolerant Plant List (Appendix 5B) in the remaining area, and use of efficient irrigation systems in all areas. Information on low water use landscaping and/or landscape packages with low water use landscaping shall be made available and displayed in a prominent manner at the model home site. For purposes of this RCM, the term "water-intensive landscaped area" means an area of land that is watered with a permanent water application system and planted primarily with plants not listed in Appendix 5B (Low Water Use/Drought Tolerant Plant List), or any modifications to the list, and the total surface area of all water features (including swimming pools of any size, fountains, ponds, water courses, waterfalls, and other artificial water structures) filled or refilled with water from any source.*
Monitoring and Reporting Requirements: *The Annual Report required by A.R.S. § 45-632 shall include a copy of the ordinance or sample conditions of new service agreement used to meet the implementation requirements for this RCM. This shall be submitted one time only (the first year of compliance with the Non-Per Capita Conservation Program) unless there is an amendment to the ordinance or agreement. Each calendar year the provider shall submit a report on the number and location of model homes built during the reporting year.* *In addition to the annual reporting requirements, the provider shall maintain and submit to the Department upon request a copy of the landscape packages or landscape information provided by each developer to new home buyers.*

PROHIBIT THE CREATION OF COVENANTS, CONDITIONS AND RESTRICTIONS WHICH REQUIRE THE USE OF WATER-INTENSIVE LANDSCAPING OR WHICH PROHIBIT THE USE OF LOW WATER USE LANDSCAPING IN NEW RESIDENTIAL DEVELOPMENTS
Description: *In an effort to promote and facilitate installation of water conserving landscaping, the provider refuses to serve water to new subdivisions which have covenants, conditions and restrictions which require the use of water-intensive landscaping or prohibit low water use landscaping. This would not prohibit water-intensive landscaping, but would allow homeowners to install the landscaping of their choice.*
Implementation: *The provider shall adopt and enforce an ordinance or establish conditions of new service requiring that developers of new subdivisions neither forbid low water use landscaping nor require water-intensive landscaping through covenants, conditions and restrictions.*
Monitoring and Reporting Requirements: *The Annual Report required by A.R.S. § 45-632 shall include a copy of the ordinance or sample conditions of new service agreement used to meet the implementation requirements for this RCM. This shall be submitted one time only (the first year of compliance with the Non-Per Capita Conservation Program) unless there is an amendment to the ordinance or agreement.*

RESIDENTIAL EXTERIOR
STANDARD RCM (CHOICE 1 OF 3)

ORDINANCE OR CONDITION OF NEW SERVICE LIMITING USE OF TURF AND OTHER WATER-INTENSIVE LANDSCAPING IN NEW MULTIFAMILY DEVELOPMENTS

Description: *The provider adopts an ordinance or establishes conditions of new service which limit and set criteria for water-intensive landscaping in multifamily developments.*

Implementation: *The provider shall adopt and enforce an ordinance or establish conditions of new service requiring that new multifamily developments meet water conserving landscaping standards, including limitation of water-intensive landscaping to individual patio areas and those areas used for active recreational purposes, and prohibiting water-intensive landscaping in all other areas, including common areas not used for active recreational purposes. In addition, the ordinance or conditions of new service shall require the use of efficient irrigation systems.* ***This RCM can be chosen only by providers with significant conservation potential in the new multifamily sector.***

Monitoring and Reporting Requirements: *The Annual Report required by A.R.S. § 45-632 shall include a copy of the ordinance or sample conditions of new service agreement used to meet the implementation requirements for this RCM. This shall be submitted one time only (the first year of compliance with the Non-Per Capita Conservation Program) unless there is an amendment to the ordinance or agreement.*

RESIDENTIAL EXTERIOR
STANDARD RCM (CHOICE 2 OF 3)

ORDINANCE OR CONDITION OF NEW SERVICE LIMITING USE OF TURF AND OTHER WATER-INTENSIVE LANDSCAPING IN COMMON AREAS OF NEW SINGLE FAMILY AND MULTIFAMILY DEVELOPMENTS

Description: *The provider adopts an ordinance or establishes conditions of new service which limits turf and other water-intensive landscaping within common areas of new single family and multifamily developments.*

Implementation: *The provider shall adopt and enforce an ordinance or establish conditions of new service requiring that water-intensive landscaping within all common areas of new housing developments not exceed 10 percent of the total landscapable area of the common area. Those areas used for active recreational purposes shall not be included in calculating the common area.*

Monitoring and Reporting Requirements: *The Annual Report required by A.R.S. § 45-632 shall include a copy of the ordinance or sample conditions of new service agreement used to meet the implementation requirements for this RCM. This shall be submitted one time only (the first year of compliance with the Non-Per Capita Conservation Program) unless there is an amendment to the ordinance or agreement.*

RESIDENTIAL EXTERIOR
STANDARD RCM (CHOICE 3 OF 3)

REBATE PROGRAM FOR NEW RESIDENTIAL CUSTOMERS
Description: *A rebate is offered for new landscapes that are designed to be efficient in water use. The landscapes may be required to meet pre-established design, plant selection, installation, and maintenance standards.*
Implementation: *The provider shall offer all new residential customers a rebate for installing low water use landscaping. The rebate shall be in the form of cash, a reduction in water bills, or a waiver or rebate of the development (hookup) fee.*
Monitoring and Reporting Requirements: *The Annual Report required by A.R.S. § 45-632 shall include the number of rebates given, the amount of money distributed to participating customers and an estimate of water savings for the reporting year.*

APPENDIX 5H.2

NON-RESIDENTIAL INTERIOR AND EXTERIOR STANDARD REASONABLE CONSERVATION MEASURES

NON-RESIDENTIAL INTERIOR
STANDARD RCM

INTERIOR AUDIT PROGRAM FOR EXISTING FACILITIES

Description: *The provider offers audits conducted by trained personnel or instructions for a self-audit to existing non-residential customers (excluding turf-related facilities, large scale cooling facilities, and landscaped public rights-of-way). These audits will be designed to include personal sanitation, cooling, and process water use as applicable for each facility. Audits for personal sanitation include visual leak detection, water budget analysis, recommendations for improved water use efficiency, staff education, and a retrofit analysis; cooling audits include education to determine system conductivity, maintenance practices, system operation, and design characteristics. Process water uses are audited where conservation potential exists. After the audit has been conducted the facility compiles information into a post-audit report to be submitted to the provider. Provider staff reviews and makes recommendations to improve water usage at the facility.*

Implementation: *The provider shall notify all existing non-residential customers (excluding turf-related facilities, large scale cooling facilities and landscaped public rights-of-way) of the availability of an audit performed on-site free of charge by staff or hired consultants, or a self-audit packet which at a minimum shall include information on how to conduct a self-audit and complete a post-audit report to be returned to the provider. The provider shall evaluate each analysis and make recommendations to the facility for water conservation potential. Existing non-residential customers that collectively receive at least 20 percent of the total non-residential water use in the provider's service area (excluding turf-related facilities, large scale cooling facilities, and landscaped public rights-of-way) shall be audited either by the non-residential customer or by trained personnel. The measurement of 20 percent of non-residential use shall be based on the most current water use records available when the provider enters the program. Annual progress requirements will be negotiated between the Department and the provider with the provider required to complete all the necessary audits by January 1, 2010.* ***This RCM shall be implemented in conjunction with the Exterior Audit for Existing Facilities.***

Monitoring/Reporting: *The Annual Report required by A.R.S. § 45-632 shall include the number of facilities audited by the provider and the number of facilities that conducted a self-audit and returned a post-audit report to the provider within the reporting year. The annual report shall include the name and type of facility audited and its annual water use for the previous year. The provider shall maintain and make available for the Department's inspection the name, address, phone number, contact person, and audit report for each facility audited.*

In addition to the annual reporting requirements, the provider shall collect, maintain and submit to the Department upon request information on selected facilities that utilize this program in order to allow an effective evaluation of the program. The number of records and type of data to be maintained will be determined at the time the provider enters the program. Note: This evaluation will be used to improve effectiveness of RCMs. It will not be used to require any modification of the negotiated Non-Per Capita Conservation Program agreement.

NON-RESIDENTIAL INTERIOR
STANDARD RCM

ORDINANCE OR CONDITION OF NEW SERVICE PROHIBITING INSTALLATION OR REPLACEMENT OF PLUMBING FIXTURES IN NON-RESIDENTIAL FACILITIES UNLESS FIXTURES MEET WATER SAVING STANDARDS

Description: *Provider adopts an ordinance or establishes conditions of new service prohibiting the installation of plumbing fixtures in new non-residential facilities and the replacement of plumbing fixtures in existing non-residential facilities unless the fixtures meet water efficiency standards. Plumbing fixtures to be covered and their respective maximum use rates are as follows:*

- *Faucets-kitchen and lavatory* — *3.0 gpm*
- *Replacement aerators - kitchen and lavatory* — *3.0 gpm*
- *Metering faucets* — *.25 gpc*
- *Gravity tank-type and flushometer toilets* — *1.6 gpf*
- *Electromechanical hydraulic toilets* — *1.6 gpf*
- *Blowout toilets* — *1.6 gpf*
- *Showerheads* — *3.0 gpm*
- *Urinals* — *1.0 gpm*
  (automatic, timed, and self-flushing urinals are prohibited)
- *Evaporative cooling systems/Decorative fountains must be equipped with water recycling or reuse systems*

Waivers may be available for unusual circumstances (e.g., hospitals and other areas where sanitation or health codes may conflict).

Implementation: *The provider shall adopt and enforce a plumbing ordinance or establish conditions of new service prohibiting the installation of plumbing fixtures in new non-residential facilities and the replacement fixtures in existing non-residential facilities unless the fixtures meet the water savings performance standards outlined in the description above. Implementation of this RCM shall include a proactive inspection and enforcement program which ensures compliance with the applicable ordinance or conditions of service.*

Monitoring/Reporting: *The annual report required by A.R.S. § 45-632 shall include a copy of the current local plumbing ordinance or sample conditions of new service agreement which meet the implementation requirements for this RCM. This shall be submitted one time only (the first year of compliance with the Non-Per Capita Conservation Program) unless there is an amendment to the ordinance or agreement.*

In addition, the provider shall include in the annual report evidence of implementation of the applicable ordinance or conditions of service by reporting the number of certificates of occupancy issued in the service area, the number of permits issued for the replacement of plumbing fixtures in existing non-residential facilities, the number of non-residential facilities inspected, the number and type of plumbing fixture violations and any enforcement action taken.

A provider that is not a city or town shall also collect and examine all inspection records for new permits issued by governmental entities for the installation of original plumbing fixtures in new facilities and the replacement of plumbing fixtures in existing non-residential facilities within the provider's service area and report any plumbing code or plumbing ordinance violations that have not been enforced to the governing body of the entity charged with enforcing the code or ordinance.

Note: This documentation will be used to evaluate the effectiveness of the RCM. It will not be used to require any modification of the negotiated non-per capita conservation program agreement.

NON-RESIDENTIAL INTERIOR
STANDARD RCM

DISTRIBUTION OF CONSERVATION INFORMATION TO ALL NEW NON-RESIDENTIAL CUSTOMERS AND SUBMITTAL OF WATER USE PLAN BY NEW LARGE FACILITIES

Description: *Provider distributes a conservation packet to all new non-residential customers when an application is submitted for a building permit. The conservation packet includes educational material on the best commercially available technologies, current codes affecting water use at each facility, and a standard form approved by the Department to be filled out by the new customer. This form will function as the water use plan to be submitted by all new non-residential customers who may potentially use 10 acre-feet or more of water annually. Turf-related facilities, large scale cooling facilities, and new large produce processing facilities are excluded from the requirement to submit a water use plan as they are required in the Industrial Conservation Program to submit a water conservation plan. Utilization of the plan helps increase the awareness of best available technologies as they become available within each industry.*

The water use plan shall identify all water uses anticipated by the user and the water conservation measures to be utilized. The water use plan shall include at least the following information (where applicable):

- *Water conservation education/training for employees*
- *Use of alternative water sources (i.e., CAP, effluent, remediated groundwater, or other non-groundwater sources)*
- *Operating TDS or conductivity for cooling towers and total cooling capacity*
- *Use of best available technologies in accordance with existing process uses (i.e., recirculating systems for process water, alternative dust control methods, automatic shut-down devices to eliminate continual running of water)*
- *Any plans for the reuse of wastewater or process water at the facility*
- *Type of landscaping and irrigation system*

Implementation: *The provider shall distribute a conservation packet as described above to all new non-residential customers prior to construction when an application is submitted for a building permit (private water companies shall distribute a conservation packet when contacted for new service). As a condition of new service, those non-residential customers who will potentially use 10 acre-feet or more of water annually, excluding turf-related facilities, large scale cooling facilities, and new large produce processing facilities, shall be required to submit a water use plan as outlined in the description above to be reviewed by water provider staff. The Department will supply to the provider the necessary form and guidelines to complete the water use plan at the time the provider enters this program. Where necessary, provider staff shall make recommendations for efficient use of water to the new user.*

Monitoring/Reporting: *The Annual Report required by A.R.S. § 45-632 shall include a copy of the sample conditions of new service agreement used to meet the implementation requirements for this RCM. This shall be submitted one time only (the first year of compliance with the Non-Per Capita Conservation Program) unless there is an amendment to the agreement. The provider shall also include in the annual report the number of conservation packets distributed annually and the number of water use plans received during the reporting year.*

In addition to the annual reporting requirements, the provider shall maintain and submit to the Department upon request the water use plans submitted by non-residential customers.

EXTERIOR AUDIT PROGRAM FOR EXISTING NON-RESIDENTIAL CUSTOMERS

***Description**: Trained auditors visit existing non-residential customers (excluding turf-related facilities, large scale cooling facilities, and landscaped public rights-of-way) to examine outdoor water use practices, or materials are supplied for a self-audit of outdoor water use practices. These audits are designed for landscape water use and include a survey of water use practices or scheduling, a visual leak detection analysis, examination of the current irrigation system maintenance and efficiency, and an examination of existing employee education or training. After the audit has been conducted the facility compiles information into a post-audit report to be submitted to the provider. Provider staff reviews and makes recommendations to improve water usage at the facility.*

Implementation:** The provider shall notify all existing non-residential customers (excluding turf-related facilities, large scale cooling facilities, and public rights-of-way) of the availability of an audit performed on-site free of charge by staff or hired consultants, or a self-audit packet which shall include at a minimum information on how to conduct a self-audit and complete a post-audit report to be returned to the provider. The provider shall evaluate each post-audit report and make recommendations to the facility for water conservation potential. Existing non-residential customers that collectively receive at least 20 percent of the total non-residential water use in the provider's service area (excluding turf-related facilities, large scale cooling facilities, and landscaped public rights-of-way) shall be audited either by the non-residential customer or by a trained auditor. The measurement of 20 percent of non-residential use shall be based on the most current water use records available when the provider enters the program. Annual progress requirements will be negotiated between the Department and the provider with the provider required to complete all the necessary audits by January 1, 2010.* ***This RCM shall be implemented in conjunction with the Interior Audit for Existing Facilities.

***Monitoring/Reporting:** The Annual Report required by A.R.S. § 45-632 shall include the number of facilities audited by the provider and the number of facilities who conducted a self-audit and returned a post-audit report to the provider within the reporting year. The annual report shall include the name and type of facility audited and its annual water use for the previous year. The provider shall maintain and make available for the Department's inspection the name, address, phone number, contact person, and audit report for each facility audited.*

In addition to the annual reporting requirements, the provider shall collect and maintain information on selected facilities that utilize this program in order to make an effective evaluation of the program. The number of records and type of data to be maintained will be determined at the time the provider enters the program. Note: This evaluation will be used to improve effectiveness of RCMs. It will not be used to require any modification of the negotiated Non-Per Capita Conservation Program agreement.

NON-RESIDENTIAL INTERIOR
STANDARD RCM

LANDSCAPE ORDINANCE OR CONDITION OF NEW SERVICE FOR NEW FACILITIES
Description: *Provider requires new non-residential customers to limit water-intensive landscaping, install efficient irrigation systems, and limit water features/fountains.*
Implementation: *The provider shall adopt and enforce an ordinance or establish conditions of new service requiring new non-residential customers with greater than or equal to 10,000 square feet of landscapable area to comply with the following, as applicable: (1) If the new non-residential customer is not a hotel or motel, the water-intensive landscaped area within the facility shall not exceed an area calculated by adding 10,000 square feet plus 20 percent of the facility's landscapable area in excess of 10,000 square feet. Schools, parks, cemeteries, golf courses, common areas of housing developments, and public recreational facilities with water-intensive landscaping greater than or equal to 10 acres are exempt from this provision, as they are regulated under the individual user requirements; (2) If the new non-residential customer is a hotel or motel, the water-intensive landscaped area within the facility shall not exceed an area calculated by adding 20,000 square feet plus 20 percent of the facility's landscapable area in excess of 20,000 square feet; (3) Only efficient irrigation systems shall be used; and (4) The use of water features and/or fountains shall be limited and shall be equipped with water recycling or reuse systems.*
Monitoring/Reporting: *The Annual Report required by A.R.S. § 45-632 shall include a copy of the ordinance or sample conditions of new service agreement used to meet the implementation requirements for this RCM. This shall be submitted one time only (the first year of compliance with the Non-Per Capita Conservation Program) unless there is an amendment to the ordinance or agreement.*

APPENDIX 5H.3

EDUCATION
STANDARD
REASONABLE CONSERVATION MEASURES

EDUCATION
STANDARD RCM

PUBLIC INFORMATION AND EDUCATION PROGRAM
Description: *Educating customers about the need for water conservation is essential to the success of any conservation program. There are many ways to educate and inform the public, including the distribution of information packets, brochures, pamphlets, bill inserts, newsletters, fact sheets, calendars, "tents" in restaurants, conducting "workshops," and radio and TV public service announcements (PSAs). Another method is the provision of information that allows customers to compare their current water use with the amount of water they used during the preceding billing period and the same billing period in the previous year. Water use tracking information may be effective because it is personalized and is updated and repeated with every billing cycle. Printed materials and PSAs can be effective for many months to the extent that they are heard, seen or read and acted upon.*
Implementation: *A minimum of once a year, the provider shall supply all customers with information on the following, using methods agreed to at the time of acceptance into the Non-Per Capita Conservation Program: 1) the significance and relevance of water conservation, and methods of conserving water, including information about conservation devices and behavioral changes that save water; and 2) how to participate in other conservation programs offered by the provider under the Non-Per Capita Conservation Program (e.g., audits, rebates, workshops). The provider shall also develop and distribute with every billing, conservation billing in either graphical or numerical format (i.e., graphs or numbers) showing current water use, the amount of water used during the preceding billing period and the same billing period in the previous year.*
Monitoring and Reporting Requirements: *The Annual Report required by A.R.S. § 45-632 shall include examples of the materials provided, a report on the methods used to contact customers, and the number of materials distributed in any form.*

APPENDIX 5H.4

***SUBSTITUTE
REASONABLE CONSERVATION MEASURES***

SUBSTITUTE REASONABLE CONSERVATION MEASURE LIST

The Substitute Reasonable Conservation Measure List for the Santa Cruz AMA is filed in the Department's Santa Cruz AMA office. A copy of the list effective as of the date of the Non-Per Capita Conservation Program follows in this Appendix. Since the list may be amended in the manner described below, a current list is available upon request from the Santa Cruz AMA office.

PROCEDURE FOR MODIFICATION OF SUBSTITUTE RCM LIST

1. *A municipal provider who seeks to add an RCM to the Substitute RCM List for the Santa Cruz AMA may apply at any time to the director for a modification of the list. The application shall be made on a form prescribed and furnished by the director.*

2. *The director shall review each request for a modification of the Substitute RCM List. The director may request additional information from the applicant and may seek information from other sources as may be necessary to determine whether the list should be modified.*

3. *If the director approves the addition of an RCM to the Substitute RCM List, the director shall place the RCM on a supplemental list that shall be considered an addendum to the Substitute RCM List. The supplemental list shall be available upon request from the Santa Cruz AMA office.*

4. *The director may add an RCM to the Substitute RCM List for the Santa Cruz AMA on the director's own initiative if the director determines that implementation of the RCM, either by itself or in combination with one or more other RCMs on the Substitute RCM List, will result in a water use efficiency for the applicable water use category equivalent to the efficiency that would result from implementation of one or more of the required RCMs for that water use category.*

SUBSTITUTE REASONABLE CONSERVATION MEASURES

RCM	Description	Implementation
	Residential Interior	
Low Flow Plumbing Rebate Program for Existing Residential Customers	*Provider grants a financial rebate to residential homeowners who elect to replace existing high water use toilets, showerheads and faucets with low-flow devices, consistent with the AWEPA.*	*Negotiated and approved by the director.*
Toilet Leak Detection & Repair Program for Existing Residential Customers	*Provider supplies non-toxic dye tablets and instructions to conduct a toilet leak detection analysis and suggestions for leak repairs.*	*Negotiated and approved by the director.*
Landscape Retrofit Program for Existing Residential Customers	*Provider grants financial incentives, including rebates, to existing customers for conversion of existing high water use landscapes to low water use landscapes. Provider supplies examples of landscape plans, plant lists, irrigation methods, and information on soil amendments and preparation.*	*Negotiated and approved by the director.*
	Residential Exterior	
Effluent Reuse - Recycled Wastewater for Existing or New Residential Customers	*Provider develops an effluent reuse system for existing or new housing developments and provides incentives for the reuse of effluent at facilities capable of utilizing the resource.*	*Negotiated and approved by the director.*
Low Water Use Ordinance or Condition of New Service for New Residential Customers	*Provider develops conditions of new service or ordinances that limit turf and other water-intensive landscaping in all new developments consistent with the new single family and multifamily residential exterior water use models in the Third Management Plan for the provider's AMA.*	*Negotiated and approved by the director.*
	Non-Residential Interior	
Retrofit Distribution or Rebate Program	*Provider supplies retrofit kits or provides rebates to non-residential facilities that elect to retrofit existing high water using plumbing fixtures to low water using fixtures consistent with the AWEPA.*	*Negotiated and approved by the director.*
Process Water Conservation Program for New or Existing Facilities	*Provider develops a program that identifies the non-residential customers within the provider's service area with the greatest conservation potential and assigns conservation measures aimed at reducing water use in these facilities.*	*Negotiated and approved by the director.*

SUBSTITUTE REASONABLE CONSERVATION MEASURES

RCM	***Description***	***Implementation***
	Non-Residential Exterior	
Rebate Program for Low Water Use Landscaping & Irrigation System Improvements for Existing or New Facilities	*Provider offers financial incentives (e.g., rebates, reduced rates, wholesale prices on plant materials, or financing packages) to non-residential facilities to replace existing landscaping and irrigation system or installation of new landscaping or irrigation systems with low water use landscaping and efficient irrigation technologies.*	*Negotiated and approved by the director.*
Effluent and Wastewater Use Incentives for Existing and New Facilities	*Provider offers incentives for conversion of existing irrigation systems or installation of new irrigation systems capable of utilizing effluent or wastewater (includes all water discharged after an industrial or commercial use, excluding effluent) for landscape watering.*	*Negotiated and approved by the director.*
Ordinance or Condition of Service Requiring The Use of Effluent for New Public Recreation Facilities	*The provider adopts an ordinance or condition of service requiring the use of effluent in new public recreation facilities, including turf-related facilities and other facilities with a water-intensive landscaped area of 10 or more acres. The ordinance or condition of new service shall require the owner of the facility to demonstrate to the Department that the facility will be designed and operated in a manner that conserves water. Publicly owned rights-of-way are exempt from this requirement. For purposes of this RCM, "turf-related facility" and "water-intensive landscaped area" have the meanings prescribed by section 6-301 of Chapter 6.*	*Negotiated and approved by the director*
	Education	
Training Opportunities	*Provider offers ongoing seminars, workshops, lectures, and videos to promote water conservation to residential or non-residential customers, employees, educators, or professional interest groups. Topics could include landscape design and maintenance, interior water conservation methods, or general background information on regional water supply issues.*	*Negotiated and approved by the director.*
Youth Programs	*Provider assists local school district(s) to provide water conservation and water supply information to students. Assistance can include classroom presentations, teacher education programs, curriculum, and field trips to water-related facilities.*	*Negotiated and approved by the director.*
Demonstration Sites and Exhibits	*Provider establishes, maintains and promotes facilities, sites, and exhibits that demonstrate water conservation including demonstration gardens, demonstration homes, conservation exhibits, and public activities.*	*Negotiated and approved by the director.*

SUBSTITUTE REASONABLE CONSERVATION MEASURES

RCM	Description	Implementation
Media-Related Outreach	*Provider to develop a media-outreach program focused on water conservation including news articles, features, and series, magazine stories, radio and television public service announcements, and television specials. Additionally, novelty items to promote local or regional conservation efforts can be distributed including buttons, posters, and bumper stickers.*	*Negotiated and approved by the director. Must include a method to evaluate effectiveness and market penetration.*
	System-Related Measures	
Water Audit Program	*Provider has an audit conducted by a trained auditor of the distribution system, accuracy of the water agency records, and systems control equipment. The audit should identify, quantify, and verify water and revenue losses to allow the provider to select and implement programs to reduce water and revenue losses. Such examination should be performed annually to update the results of earlier audits. The audit must include an analysis of the water audit results and possible corrective measures including resulting costs, feasibility, and savings.*	*Negotiated and approved by the director.*
Leak Detection Program	*Provider implements a leak detection program in conjunction with a water audit (see substitute RCM - Water Audit). The leak detection program must address losses due to leaks, unauthorized use (street, sewer, and fire departments), water department maintenance, and meter under-registration and must include repair, maintenance, and meter testing. Flushing frequency and exercise of valves should also be accounted for.*	*Negotiated and approved by the director.*
Conservation-Based Rate Structure	*Provider develops a water rate structure which results in slowing the increase in water consumption that traditionally accompanies increases in population and per capita income. Pricing structures which may result in conservation are: increasing block rate, lifeline rate, seasonal rate, and excess demand surcharge. To be effective, the rate structure must clearly send a conservation message. The rates structure established should ensure that customers receive the proper signal that allows them to make a choice as to whether or not to implement conservation measures. Additionally, the water rate revision should be accompanied by a public awareness campaign, a water conservation device distribution program, pamphlets on low water use landscaping, or other conservation measures to increase the effectiveness of the program.*	*Negotiated and approved by the director.*

SUBSTITUTE REASONABLE CONSERVATION MEASURES

RCM	Description	Implementation
Conservation Coordinator	*Provider employs a staff person whose sole responsibility is to ensure the implementation of effective water conservation programs. The employee would act to coordinate conservation efforts in conjunction with utility staff and be the primary contact for the public regarding conservation information. The coordinator could initiate an information campaign including: pamphlets, fact sheets, bill stuffers, public service announcements, and press releases. The coordinator can also coordinate direct conservation activities other than education.*	*Negotiated and approved by the director. Includes submittal of a complete job description for the position as well as annual goals and objectives for the program.*
Water Tampering and Water Waste	*Water provider adopts and enforces ordinances or implements policies regarding excessive and wasteful use of water. Meter reading staff and customers report water theft where ordinances are not applicable. Staff performs regular checks of water delivered and water used in distinct parts of the service areas where there is greater susceptibility to water theft.*	*Negotiated and approved by the director.*

APPENDIX 5I
ALTERNATIVE CONSERVATION PROGRAM
RESIDENTIAL CONSERVATION REQUIREMENT COMPONENT CALCULATIONS
SINGLE FAMILY HOUSING UNITS
SANTA CRUZ ACTIVE MANAGEMENT AREA

1. Existing Residential Allotment

   a. Determine the population in single family housing units as of July 1, 2000,
   Determine the population in multifamily housing units as of July 1, 2000,
   Add the Single Family and Multifamily Population to determine Year 2000 Residential Population;

   b. Multiply the year 2000 residential population by the provider's existing residential GPCD component (Appendix 5B), multiply this number by 365 days, and divide the product by 325,851;

   c. The result is an annual volumetric allotment, in acre-feet, for existing residential uses. Reasonable reductions in GPCD are included in the annual target calculation.

2. New Single Family and Multifamily Residential Allotment:

   a. Determine the new single family housing units added since July 1, 2000,
   Determine the new single family population (post-7/1/00) for the calendar year,
   Determine the new multifamily housing units added since July 1, 2000,
   Determine the new multifamily population (post-7/1/00) for the calendar year;

   b. Multiply the new single family housing units and the new multifamily population by the exterior rates for new residential development:

   Single Family = 107 GPHUD
   Multifamily = 26 GPHUD

   Add the products, multiply the result by 365 days, and divide the product by 325,851;

   c. Multiply the sum of the new single family population and the new multifamily population by the interior rate for new residential development of 57 GPCD, multiply the result by 365 days, and divide the product by 325,851;

   d. Add the results from subparagraphs 2.a and 2.b. The sum is an annual volumetric allotment, in acre-feet, for new residential uses.

3. Add the existing residential allotment from subparagraph 1.c and the new residential allotment from subparagraph 2.d. The sum is the TOTAL RESIDENTIAL ALLOTMENT for the calendar year.

APPENDIX 5J
CONSERVATION REQUIREMENTS FOR MUNICIPAL DISTRIBUTION SYSTEMS
LOST AND UNACCOUNTED FOR WATER
SANTA CRUZ ACTIVE MANAGEMENT AREA

Lost & Unaccounted For Includes:

Leaks:
- Distribution Lines
- Sewer Lines
- Storage Tanks
- Storage Ponds
- Hydrants
- Other

Breaks:
- Distribution Lines
- Sewer Lines
- Mains
- Hydrants
- Other

Measurement Errors:
- Meter Under-Registration
- Source Meter Errors
- Flume/Weir Errors

Evaporation

Illegal Connections/Water Theft

Phreatophyte Uses

Water System Uses Include:

- Residential Metered Deliveries
- Non-Residential Metered Deliveries
- Standpipe Uses
  - *(1)* Fire Flow
  - Hydrant Meter Reading
  - *(1)* Hydrant Flow Tests
  - *(1)* Fire Sprinkler System Flow Tests
  - *(1)* Construction
  - *(1)* Dust Control
  - *(1)* Line Flushing (distribution, sewer, or treatment facility)
  - *(1)* Street Cleaning
  - *(1)* Storm Drain Flushing
  - *(1)* Water Tests & Pressure Tests
  - Well Purging

(1) *These uses may be estimated using a method approved by the director. Documentation must be submitted with annual report.*

APPENDIX 5K
INCIDENTAL RECHARGE FACTOR CALCULATION
SANTA CRUZ ACTIVE MANAGEMENT AREA

Hydrologic Studies
The following information must be provided:

1. A copy of a hydrological study that demonstrates the amount of water supplied by the municipal provider for use within its service area during each of the preceding five years (prior to application to the Non-Per Capita Conservation Program) and the amount of incidental recharge as calculated below that occurred within the municipal provider's service area during each of those years.

2. A copy of a hydrological study that projects the average annual amount of water that the municipal provider will supply for use within its service area during the management period and the average annual amount of incidental recharge as calculated below that will occur within the municipal provider's service area during the management period.

Calculation of the Incidental Recharge and an Incidental Recharge Factor
The following information should be included in the hydrologic studies:

1. A map showing:
   a. Service area boundary.
   b. Location of turfed areas and/or unlined lakes greater than 10 acres where water is provided by the municipal provider applying for the Non-Per Capita Conservation Program.
   c. Location of areas which are served by septic systems.

2. For turfed and water acres:
   a. Combined actual turfed and water acres (of facilities greater than or equal to 10 acres).
   b. Plant consumptive use (actual or using consumptive use rate published in the Second Management Plan), or measured evaporation rates.
   c. Total annual volume of water applied to facility. If only a portion of the water used is supplied by the municipal provider, document the percentage supplied by the provider who is applying for the Non-Per Capita Conservation Program and from other sources.

3. For septic systems:
   a. The number of acres of lots served by septic systems and the number of septic tanks per acre.
   b. Volume of water supplied to that system and documentation of the volume of water incidentally recharged. If only a portion of the water used is supplied by the municipal provider, document the percentage supplied by the provider and from other sources.

4. Total annual volume of water supplied by a provider for use within its service area.

5. Any other data which contributes to incidental recharge within the service area. The Department will review the data and take them under consideration.

APPENDIX 5K *(continued)*
INCIDENTAL RECHARGE FACTOR CALCULATION
SANTA CRUZ ACTIVE MANAGEMENT AREA

Calculations

1. Turf

Annual Incidental Recharge (AF)	=	Total Annual Water Used (AF)	-	[Turfed Acres x Consumptive Use AF/Ac.]

2. Artificial Lakes

Annual Incidental Recharge (AF)	=	Total Annual Water Used (AF)	-	[Lake Acres x Evaporation Rate AF/Ac.]

3. Septic Systems

Annual Incidental (AF)	=	Total Acres of Septic System	x	Number of Septic Systems per Acre	x	Total Annual Water Use per Household(AF)	x	% Water Returned for Recharge

4. **Maximum Estimated Annual Incidental Recharge (AF)** = #1 + #2 + #3 + other data approved by ADWR

5. **Incidental Recharge Factor** = $\dfrac{\text{Annual Incidental Recharge (\#4)}}{\text{Total Annual Volume of Water Pumped and Received.}}$

APPENDIX 5L
LARGE MUNICIPAL PROVIDER EXISTING RESIDENTAL CONSERVATION POTENTIAL
SANTA CRUZ ACTIVE MANAGEMENT AREA

Municipal Water Provider	Interior Conservation Potential	Exterior Conservation Potential
Citizens' Water Resources - Tubac	Maximum	Maximum
City of Nogales	Moderate	Maximum
Rio Rico Utilities, Inc.	Moderate	Moderate
Valle Verde Water Company	Moderate	Minimum

CHAPTER

6

Industrial Conservation Program

6.1 INTRODUCTION

This chapter contains the Arizona Department of Water Resources' (Department) conservation program for industrial users within the Santa Cruz Active Management Area (AMA). The purpose of the Industrial Conservation Program is to move industrial water users within the AMA to the greatest level of efficiency economically attainable given use of the latest available water conservation technology. In addition to conservation, the degree to which any new industrial users can directly reuse wastewater generated from new subdivisions will assist in maintaining safe-yield conditions and preventing long-term declines in local water table levels in the AMA.

The Groundwater Code (Code) defines industrial use of water as "a non-irrigation use of water not supplied by a city, town, or private water company, including animal industry use and expanded animal industry use." A.R.S. § 45-561(5). An industrial user is a person who uses water withdrawn from a well for an industrial use. In many cases industrial users withdraw water from their own wells pursuant to Type 1 or Type 2 non-irrigation grandfathered rights or a groundwater withdrawal permit. These rights and permits (collectively referred to in this chapter as "industrial rights") have annual volumetric water allotments. The total volume of Type 2 rights in the AMA was set at the time the Code was enacted. The total volume of water associated with Type 1 rights can increase over time as agricultural land with irrigation grandfathered rights is retired from production and the rights are converted to Type 1 non-irrigation grandfathered rights. General Industrial Use (GIU) permits are issued by the Department if water service cannot be secured from a municipal provider and if the use of surface water or effluent, or the purchase or lease of a grandfathered right, is not economically feasible. Permits expire after a specified period of years.

There are also types of water users that, although served by a municipal water provider, are subject to industrial program conservation requirements through the Municipal Conservation Program. These users include turf-related facilities and are referred to in the Municipal Conservation Program as "individual users."

Conservation is an important tool for maintaining safe-yield conditions and preventing long-term declines in local water table levels. Industrial facilities generally use water efficiently due to pumping costs and industrial discharge limitations that require them to recycle water and contain water on-site. The allotment-based conservation requirements for the turf industry have required turf-related facilities to comply with declining application rates per acre since the First Management Plan became effective. This program has resulted in significant conservation savings through efficient use of water.

Industrial users have the legal authority to withdraw water from wells up to the annual allotment of their rights or permits subject to management plan conservation requirements. In the Santa Cruz AMA, adding new demands within the Younger Alluvium of the Santa Cruz River could result in a long-term decline in local water table levels unless the withdrawals are offset by recharge or the water to meet the new demands is brought in from another location, such as direct use of effluent from a wastewater treatment pond or small local wastewater treatment plant. The logistics, cost, and Arizona Department of Environmental Quality (ADEQ) reuse standards that apply in using this source of water make it unattractive and in some cases infeasible as an alternative source of supply. Therefore, nearly all water users in the Santa Cruz AMA, including industrial users, rely on water withdrawn from the Younger Alluvium of the Santa Cruz River. There are no industrial users within the AMA who are currently using effluent to meet their water demands.

In all the AMAs, significant amounts of industrial right allocations are unused. These unused allocations represent a potential increase in water withdrawals allowable under statute. Depending on the location of water withdrawals associated with these rights, an increase in withdrawals up to the total allocation could affect local water table levels in the long term. Because of the volume of industrial right allocations that are not currently being used, there is significant potential for the industrial sector in the Santa Cruz AMA to expand.

For the third management period, there are general conservation requirements that apply to all industrial users. In addition to these requirements, there are specific conservation requirements that apply to the following industrial users in the Santa Cruz AMA:

- Turf-Related Facilities (≥10 acres)
- Sand and Gravel Facilities (>100 acre-feet/year)
- New Large Landscape Users (>10,000 square feet of water intensive landscape)
- New Large Industrial Users (>100 acre-feet/year)

Industrial water uses in the Santa Cruz AMA consist primarily of landscape watering and sand and gravel operations. Industrial demand as a percentage of overall water use in the Santa Cruz AMA has remained fairly stable over the last 15 years. Industrial users with water rights or permits accounted for about 7 percent of the AMA water use in 1995 or about 1,400 acre-feet. It is difficult to project industrial water use in the Santa Cruz AMA since less than 15 percent of the industrial water allocations are being used, and future developments that may include golf courses are not known. If the current ratio of industrial demand to AMA population is used to project use, industrial water demand could be close to 3,000 acre-feet by the year 2025. If this increase in demand occurs within the Younger Alluvium of the Santa Cruz River, alternatives to withdrawing water from wells will need to be developed in order to protect water table levels from long-term declines.

This chapter is organized as shown below. Following the Introduction, each Industrial Conservation Program is discussed under a separate subsection. In general, each of the subsections contain all or some of the following: (1) an introduction, (2) water use by the subsector, (3) First and Second Management Plan program development, (4) issues and Third Management Plan development, (5) program description, (6) non-regulatory efforts, (7) future directions, and (8) subsector conservation requirements.

- Introduction
  - Statutory Provisions
  - Industrial Program Development
  - Industrial Program Issues
  - Non-Regulatory Efforts
  - Future Directions
- All Industrial Users
- Turf-Related Facilities
- Sand and Gravel Facilities
- New Large Landscape Users
- New Large Industrial Users

6.1.1 <u>Statutory Provisions</u>

6.1.1.1 Conservation Requirements

The Code requires that the management plan contain a conservation program for industrial users. For the third management period the director is required to establish for the Santa Cruz AMA:

> additional conservation requirements for all non-irrigation uses of water, other than stored water, withdrawn from a well to be achieved by the end of the third management period and may establish intermediate conservation requirements to be achieved at specified intervals during the third management period. . . . For industrial uses including industrial uses within the exterior

boundaries of the service area of a city, town, private water company or irrigation district, the program in each plan shall require the use of or establish conservation requirements based on the use of the latest commercially available conservation technology consistent with reasonable economic return. A.R.S. § 45-566(A)(2).

6.1.1.2 Individual User Requirements

The Code also requires the establishment of additional conservation requirements for municipal uses in the Third Management Plan including "use of such other conservation measures as may be appropriate for individual users." A.R.S.§ 45-566(A)(2). (See Chapter 5.) In the First Management Plan, only turf-related facilities receiving water from municipal providers were regulated as individual users. These facilities were subject to the requirements of the Industrial Program as if they were industrial users. Thus, regardless of the source of water, whether from a municipal provider or from the facility's own wells, all turf-related facilities were subject to the turf-related facility conservation requirements in the Industrial Program chapter of the First Management Plan.

Similarly, in the Second Management Plan, turf-related facilities receiving water from a municipal provider were regulated as individual users and were subject to the Second Management Plan's industrial program conservation requirements for turf-related facilities. In addition, new large cooling tower users, which are typically served by water providers, were also regulated as individual users in the Second Management Plan. These facilities were required to comply with the conservation requirements established for new large cooling tower users in the Industrial Program chapter.

6.1.2 Industrial Program Development

The Industrial Conservation Program has evolved into a more technically sophisticated program since the First Management Plan. This has been the result of considerable input and cooperation by the regulated community, as well as investigative efforts by the Department.

The First Management Plan requirements stressed water use efficiency and contained other general requirements. There were specific conservation programs only for metal mines, turf-related facilities, electric power plants, sand and gravel facilities, and other industrial users. As a result of consultant studies done for the Second Management Plan, additional conservation requirements were added for new large-scale cooling users, dairies, cattle feedlots, new large industrial users, and new large landscape users. In addition, there was a more specific effluent incentive provision for turf-related facilities.

Development of the Third Management Plan conservation requirements included extensive participation by a wide cross-section of industry representatives, including facility managers, consultants, municipal representatives, vendors, land developers, and academic research specialists. Technical Advisory Committees (TACs) were formed for the development of specific conservation requirements for turf-related and sand and gravel facilities found in the Industrial Conservation Program in this plan. Although there was no industry representation from the Santa Cruz AMA included in the TACs, representatives from the turf and sand and gravel sectors held a wide range of opinions and brought significant technical knowledge to the Department allowing for the development of a program that considers industry needs and addresses water conservation objectives.

Collectively, over 30 meetings were held with the committees over a one and one-half year period. Committee members had an opportunity to help formulate and suggest conservation requirement alternatives, provide industry expertise, and review final programs. In the Santa Cruz AMA, the developing conservation program components were presented and discussed at Groundwater Users Advisory Council (GUAC) meetings and comments were requested and received during this process.

In the Third Management Plan, separate industrial program categories have been created for new large landscape users and new large industrial user subsectors. These two industrial water use groups were included in the "all industrial users" category in the Second Management Plan but have been separated out to more clearly present the water use characteristics and specific conservation requirements for the third management period. This results in a total of four industrial program subsectors in the Third Management Plan for the Santa Cruz AMA: (1) turf-related facilities, (2) sand and gravel facilities, (3) new large landscape users, and (4) new large industrial users. There are industrial users in all of these categories in the Santa Cruz AMA except for new large landscape users and new large industrial users. Some AMA management plans have a conservation program for metal mining facilities, large-scale power plants, large-scale cooling facilities, dairy operations, and cattle feedlot operations. If any of these facilities should come into existence in the Santa Cruz AMA during the third management period, the management plan may be modified to include the conservation program for that subsector.

Industrial subsector requirements vary from allotment-based requirements to the implementation of specific conservation measures. In all cases, the requirements have been developed consistent with the statutory requirement to establish conservation requirements that require the use of, or are based on the use of, "the latest commercially available conservation technology consistent with reasonable economic return." A.R.S. § 45-566(A)(2).

For the Third Management Plan, the Department reviewed the existing subsector programs and tried to address any existing problems or deficiencies. In most instances, specific conservation requirements for the third management period are not significantly different from those in the Second Management Plan. Conservation requirements in the First and Second Management Plans have been effective in improving water use efficiency for certain industrial subsectors. In the Third Management Plan, a number of technical corrections have been made, requirements have been added, additional program alternatives have been included, and renewable supply use incentives have been added or adjusted to be more effective. The specific changes, issues, and renewable supply incentives that were considered in subsector program development are discussed in the subsector sections of this chapter.

6.1.3 Industrial Program Issues

The Department considered a number of issues associated with the Industrial Program as it developed the Third Management Plan. Several issues emerged that have long-term implications for industrial water use. Some issues can be addressed using existing statutory and regulatory mechanisms while others may require a statutory amendment. The Department will continue to pursue opportunities to address these issues. The sections below provide additional detail on industrial program issues.

6.1.3.1 Use of Renewable Supplies by Industrial Users

Effluent is currently a consistently available renewable supply to water users in the Santa Cruz AMA. Physical access to this supply is limited for most industrial users. Potential users are often far removed from the effluent source and the cost of constructing delivery systems constrains utilization. Since industrial users have legal authority to withdraw water from their own wells at a cost composed primarily of relatively low energy costs, there is no economic incentive to incur the additional expense associated with the purchase, delivery, and possible treatment of effluent.

Incentives for effluent use were considered in the development of specific programs for the industrial categories and are discussed under the following sections. Additional opportunities need to be identified during the third management period with consideration given to the impact of the sector on attainment of safe-yield and maintenance of water table levels that support current and future water users.

6.1.3.2 Matching Water Quality and Uses

Each industrial user category has its own water quality requirements related to the particular product or process involved. Although some users may require high quality water, others do not. For example, turf facilities are able to use effluent without any significant adverse impact and sand and gravel facilities can use effluent for aggregate washing. Poor quality groundwater may be acceptable for certain industrial uses. The Palo Duro golf course may use water from the United Musical Instruments Resource Conservation Recovery Act (RCRA) cleanup project that has been treated to almost drinking water quality. Obvious constraints on use include location of the supply in relation to the facility, cost and pre-treatment needs.

In 1997, the Legislature enacted legislation significantly revising the Water Quality Assurance Revolving Fund (WQARF) Program to provide incentives for the use of remediated groundwater to facilitate the treatment of contaminated groundwater. Among other things, the WQARF legislation provides that when determining compliance with management plan conservation requirements, the Department shall account for groundwater withdrawn pursuant to approved remedial action projects under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, consistent with the accounting for surface water. Laws 1997, Ch. 287, § 51(B). See Chapter 7, section 7.4.4.6.3. Groundwater withdrawn pursuant to an approved remedial action project retains its legal character as groundwater for all other purposes under Title 45, Arizona Revised Statutes, including all other laws regulating groundwater withdrawal and use such as the assessment of withdrawal fees pursuant to A.R.S. § 45-611, *et seq*., as well as laws regulating water exchanges as set forth in A.R.S. § 45-1001, *et seq*.; the transportation of groundwater as set forth in A.R.S. § 45-541, *et seq*.; withdrawals of groundwater for transportation to active management areas as set forth in A.R.S. § 45-551, *et seq*.; and underground water storage, savings, and replenishment as set forth in Title 45, Chapter 3.1, Arizona Revised Statutes.

For each approved remedial action project, the annual amount of groundwater that is eligible for the remediated groundwater accounting incentive is the maximum annual volume of groundwater that may be withdrawn pursuant to the project, as specified in the consent decree or other document approved by the Environmental Protection Agency (EPA) or ADEQ. However, if the project was approved prior to June 15, 1999 and the maximum annual volume of groundwater that may be withdrawn pursuant to the project is not specified in a consent decree or other document approved by the EPA or ADEQ, the annual amount of groundwater that is eligible for the remediated groundwater accounting incentive is the highest annual use of groundwater withdrawn pursuant to the project prior to January 1, 1999. The director may modify the annual amount of groundwater that is eligible for the accounting incentive if an increase in withdrawals is necessary to further the purpose of the project or if a change is made to the consent decree or other document approved by the EPA or ADEQ. For the Santa Cruz AMA, contaminated water that is treated that qualifies under this provision will be considered surface water not withdrawn from a well, as opposed to water withdrawn from a well, for the purposes of determining compliance. This means that in determining compliance, remediated water will be included in the total water use of a facility, but it will be counted first so that any water used by the facility above the allotment will only be comprised of water withdrawn from a well. Also, if a facility uses 100 percent remediated water, the conservation requirement will not apply. See Chapter 10 for more details regarding the determination of compliance with conservation requirements.

In order to qualify for the remediated groundwater accounting incentive, a person must notify the director in writing of the anticipated withdrawal of the remediated water prior to its withdrawal. The notification must include a copy of a document approved by ADEQ or the EPA such as the Remedial Action Plan (RAP), a Record of Decision (ROD), or consent decree. Unless specified in the document, the notification must include the volume of groundwater that will be pumped annually pursuant to the project, the time period to which the document applies, and the annual authorized volume of groundwater that may be withdrawn pursuant to the project. The notification must also include the purpose for which the remediated groundwater will be used and the name and telephone number of a contact person. Additionally, at the time the notice is given, the person must be using remediated groundwater pursuant to the approved remedial action or must have agreed to do so through a consent decree or other document approved by ADEQ or EPA. Remediated groundwater which qualifies for the accounting must be metered and reported separately from water withdrawn from wells that does not qualify for the accounting. (See section 6-204 of the Conservation Requirements for All Industrial Users).

6.1.3.3 Unused Allotment

There is a large volume of unused water right and permit allocations associated with the industrial sector. Rights and permits held by industrial users total nearly 9,000 acre-feet. In 1995, the unused portion was more than 7,500 acre-feet. If the entire unused allotment volume were pumped, it would be a serious hindrance to maintaining safe-yield conditions and preventing long-term declines in local water table levels. Similarly, if this unused allotment were allowed to be extinguished for credits in proving an assured water supply, the net result would be an increase in withdrawals over current demand levels and the AMA goals might still be jeopardized unless the demand were offset through replenishment. Extinguishment of the rights that are currently in use would maintain the balance of demands and supplies within the AMA, but this would require the industrial use to be permanently eliminated and replaced with an equal volume of municipal demand. This is extremely unlikely to occur.

6.1.3.4 General Industrial Use and Mineral Extraction Permits

GIU permits are issued under A.R.S. § 45-515 for industrial uses located outside of water provider service area boundaries pursuant to certain conditions and are valid for a specified period of time. Permits may also be issued for mineral extraction and metallurgical processing under A.R.S. § 45-514. These permits allow groundwater pumping in addition to withdrawals pursuant to existing industrial rights. The total volume of water permitted in the Santa Cruz AMA in 1995 was 853 acre-feet, including GIU permits, mineral extraction permits and poor quality water withdrawal permits. The amount of water withdrawn pursuant to these permits in 1995 was only 156 acre-feet.

6.1.4 Non-Regulatory Efforts

During the second management period, it became apparent that water use by small schools in the AMA was increasing and, due to steady population growth in the area, could continue to increase as more schools were opened to accommodate new students. Therefore, it would benefit all water users in the AMA if small schools were able to incorporate conservation measures into their daily interior and exterior water use. Voluntary participation in a conservation program could include staff education and student projects pertaining to audits of turf and landscape plant water needs, irrigation system design and efficiency, the potential for removal of high water use landscaping in entry and non-sporting areas and even audit of interior water use, and retrofit of fixtures and changes in use habits. Education could be provided covering the installation and efficient use of automatic irrigation systems where only manual systems are presently used. Information on the proper timing, length of watering, and frequency of watering of turf and landscaped areas could be included in the education program. The detection and repair of broken and leaking sprinkler heads, pipes, and valves should be of primary concern in a program dedicated to water conservation. Similar attention could be placed on interior uses of water; however, the majority of water use at schools is for landscape watering. The AMA could set aside water management assistance funds to implement conservation measures. These activities could be included as part of a water conservation program curriculum. The AMA could potentially sponsor a water conservation competition among schools that would honor the school with the greatest water savings obtained through conservation efforts.

The Department is committed to continuing its efforts to assist regulated industrial users in meeting their conservation requirements through direct staff assistance and through its water management assistance program during the third management period. This effort could be in the form of technical assistance or the funding of research on new water conservation technologies.

6.1.5 Future Directions

The Santa Cruz AMA has the potential for future growth in the industrial sector. Maintaining water use efficiency, providing conservation and technical assistance, and developing opportunities for the direct use of effluent generated by new subdivisions and treated at small, local treatment plants or ponds could be the likely future directions for the industrial sector. The future of industrial users in relation to the management goals is largely shaped by the potential for growth in the water use and existing constraints on replacing water use with the direct use of effluent.

There are a number of Type 1 non-irrigation grandfathered rights presently unused in the AMA. If these rights are put to use by future industrial water users, the goals of achieving safe-yield and maintaining local water table levels will become more and more difficult to meet. Apart from the water right retirement provision in the Code, and the water right extinguishment provisions in the current Assured Water Supply Rules (AWS Rules), there is no regulatory authority in place to reduce water right withdrawals. The Department has decided not to include a grandfathered right purchase and retirement program in the Third Management Plan. The extent to which the extinguishment provisions in the AWS Rules will limit industrial use is not possible to predict. It might be necessary to examine replenishment approaches to offset a portion of industrial withdrawals to meet the AMA goals.

Two mechanisms for water management in the AMA are increased use of effluent for industrial purposes and implementation of maximum water conservation measures. Conservation technologies and practices could be further evaluated, while an increase in funding for conservation and education could assist industrial water users with water management practices, evaluation of effective water conservation technology, and construction of conveyance infrastructure for the use of effluent. Additional incentive programs designed to promote increased use of effluent could be developed by the Department during the third management period.

Industrial water uses may change as new technologies are developed. Research may need to be conducted during the third management period to investigate water conserving opportunities associated with use of these technologies by certain industrial users. This research could be used to develop conservation requirements for the Fourth Management Plan, possibly for different sub-sectors of industrial users than those included in the Third Management Plan.

6.2 ALL INDUSTRIAL USERS

6.2.1 Introduction

The conservation requirements in this section apply to all industrial water users. In addition to these requirements, certain industrial users are also required to comply with conservation requirements specific to their type of water use under other sections of this chapter. For example, a sand and gravel facility must comply with the requirement in this section to use low-flow plumbing devices at the facility to the maximum extent possible and, in addition, must comply with the conservation requirements in section 6.4.6 of this chapter.

The following industrial users are required to comply with the conservation requirements for all industrial users in this section, as well as conservation requirements for their specific type of water use in other sections of this chapter: turf-related facilities, sand and gravel facilities, new large landscape users, and new large industrial users. All remaining industrial users are referred to in this section as "other industrial users" and are required to comply only with the conservation requirements for all industrial users in this section.

6.2.2 Water Use by "Other Industrial Users"

"Other industrial users" in the Santa Cruz AMA used approximately 160 acre-feet of water in 1995, which accounted for about 12 percent of the total industrial water withdrawals in the AMA in that year. None of this amount was used by "large" users (more than 100 acre-feet per year). Many different types of commercial and manufacturing uses may be included in this category.

There are about 45 water rights and permits associated with the "other industrial user" category in the Santa Cruz AMA. The total annual water right allotment associated with these rights is more than 7,000 acre-feet. Of that amount, over 5,500 acre-feet consists of Type 1 rights that have used less than 15 acre-feet in sum during the period from 1984 through 1997. Type 2 rights make up an additional 514 acre-feet of allotment of "other industrial use." In 1995, about 110 acre-feet of water was withdrawn for other industrial uses pursuant to Type 2 rights.

6.2.3 Program Development and Issues

In the First Management Plan, "other industrial users" were required to avoid waste and make efforts to recycle water. In addition, they were prohibited from using single-pass cooling or heating. These requirements and others were also included in the Second Management Plan for all industrial users.

Consultant studies done in preparation of the Second Management Plan investigated water use associated with landscaping, heating and cooling, and sanitary and kitchen water use practices. These studies identified areas of water conservation potential and appropriate water conservation techniques. The Department has determined that the findings from these studies still apply to current industrial use and practices.

The following techniques are recommended for achieving water conservation in the industrial sector:

- reusing or recycling water
- avoiding single-pass cooling unless the water is reused
- use of low flow plumbing fixtures
- use of low water use landscaping with efficient irrigation systems
- developing site-specific water conservation plans for large facilities

Most of these techniques are included in the conservation requirements for all industrial users detailed in section 6.2.5 and apply to "other industrial users" as well as industrial users subject to conservation requirements for their specific type of water use. The Third Management Plan requirements are intended to send a strong conservation message to all industrial users to use water efficiently.

The Department also inventoried the "other industrial user" category during the planning process for the Third Management Plan to determine if there were any user groups with sufficient usage and conservation potential to warrant specific conservation requirements. The diverse nature of water uses within this category make it difficult to formulate volumetric conservation requirements which address the various types of industries. There are, however, some opportunities for water conservation.

The greatest conservation potential within the "other industrial users" category is in cooling and landscape watering which are uses common to most facilities. Commercial landscapes may not be well maintained and automatic irrigation controller clocks may not be adjusted to match weather conditions.

6.2.4 <u>All Industrial Users Conservation Program</u>

The Third Management Plan conservation program for all industrial users is similar to the Second Management Plan program. All industrial users are required to avoid waste and make diligent efforts to recycle water. Single-pass cooling or heating is not allowed unless the water is reused, and low-flow plumbing fixtures must be used as required by the state or local plumbing code. Since January 1, 1994, the Arizona Statewide Plumbing Code has required the use of low-flow fixtures in new construction throughout the state and some local plumbing ordinances have even more stringent standards.

There are two new landscaping requirements in the Third Management Plan. Industrial users that are not regulated as a turf-related facility or as a new large landscape user are required to use low water use landscape plants where feasible and water with efficient irrigation systems. Improving irrigation efficiency can be a source of major water savings whether the plants have high or low water needs. The Department encourages all facilities to irrigate efficiently regardless of the type of vegetation planted. In addition, industrial users are prohibited from serving water withdrawn from wells, other than stored water, to vegetation planted in a public rights-of-way after January 1, 2002 unless the plants are on the low water use plant list for the AMA and are prohibited from serving water withdrawn from wells, other than stored water, to a water feature, such as a fountain, waterfall, pond, water course, or other artificial water structure, in the rights-of-way if installed after January 1, 2002.

6.2.5 <u>Industrial Conservation Requirements and Monitoring and Reporting Requirements for All Industrial Users</u>

6-201. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in sections 6-202 through 6-203 of this chapter shall have the following meanings:

1. *"Existing facility" means an industrial facility or individual user that was constructed and substantially commenced operation by December 31, 1999.*

2. *"Industrial process purposes" means water which is used by an industrial user directly in the creation or manufacture of a product.*

3. *"Industrial use" means a non-irrigation use of water not supplied by a city, town, or private water company, including animal industry use and expanded animal industry use.*

4. *"Industrial user" means a person who uses water for industrial uses.*

5. *"Low-flow plumbing fixture" means a lavatory faucet, lavatory faucet replacement aerator, kitchen faucet, kitchen faucet replacement aerator, shower head, urinal, water closet, or evaporative cooler designed to meet the use rates specified in A.R.S. §§ 45-312 and 313 or the applicable county or city code, whichever is more restrictive.*

6. *"Single-pass cooling and heating" means the use of water without recirculation to increase or decrease the temperature of equipment, a stored liquid or a confined air space.*

7. *"Wastewater" means water that is discharged after an industrial or municipal use, excluding effluent.*

6-202. Conservation Requirements

Beginning on January 1, 2002 or upon commencement of water use, whichever is later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, an industrial user shall comply with the following requirements:

1. *Avoid waste; use only the amount of water from any source, including effluent, reasonably required for each industrial use; and make diligent efforts to recycle water.*

2. *Do not use water for non-residential single-pass cooling or heating purposes unless the water is reused for other purposes.*

3. *Use low-flow plumbing fixtures as required by Title 45, Chapter 1, Article 12, Arizona Revised Statutes, or any applicable county or city code, whichever is more restrictive.*

4. *Use plants listed in Appendix 5B, Low Water Use/Drought Tolerant Plant List or any modifications to the list, for landscaping to the maximum extent feasible, and water with a water-efficient irrigation system. An industrial user regulated as a turf-related facility*

under sections 6-301, et seq., or as a new large landscape user under section 6-501, et seq., is exempt from this requirement.

5. *Do not serve or use water for the purpose of watering landscaping plants planted on or after January 1, 2002 within any publicly owned rights-of-way of a highway, street, road, sidewalk, curb, or shoulder which is used for travel in any ordinary mode, including pedestrian travel, unless the plants are listed in Appendix 5B, Low Water Use/Drought Tolerant Plant List or any modifications to the list. The director may waive this requirement upon request from the industrial user if a waiver is in the public interest. This requirement does not apply to any portion of a residential lot that extends into a publicly owned rights-of-way.*

6. *Do not serve or use water for the purpose of maintaining a water feature installed after January 1, 2002 within any publicly owned rights-of-way of a highway, street, road, sidewalk, curb, or shoulder which is used for travel in any ordinary mode, including pedestrian travel. The director may waive this requirement upon request from the industrial user if a waiver is in the public interest. This requirement does not apply to any portion of a residential lot that extends into a publicly owned rights-of-way.*

6-203. Monitoring and Reporting Requirements

A. Requirements

For calendar year 2002 or the calendar year in which the facility first begins to use water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the Fourth Management Plan, an industrial user shall, except as provided for in subsection B of this section, include the following information in its annual report required by A.R.S.§ 45-632:

1. *The total quantity of water by source, including effluent, withdrawn, diverted, or received during the reporting year for industrial process purposes, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

2. *The total quantity of water by source, including effluent, withdrawn, diverted, or received during the reporting year for purposes other than industrial process purposes, listed in paragraph 1 of this subsection, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

3. *An estimate of the quantity of wastewater generated during the reporting year.*

4. *An estimate of the quantity of wastewater recycled during the reporting year.*

5. *A description of the primary purposes for which water from any source, including effluent, is used.*

6. *The number of acres of land that were planted with low water use plants during the calendar year as a result of removal of plants not on the low water use plant list for the Santa Cruz AMA, if more than one acre, and the method of irrigation for those acres. An industrial user regulated as a turf-related facility under sections 6-301, et seq., or as a new large landscape user under section 6-501, et seq., is exempt from this requirement.*

B. Exemption

An industrial user who holds a Type 1 or Type 2 non-irrigation grandfathered right or a groundwater withdrawal permit in the amount of 10 or fewer acre-feet per year is exempt from the requirements set forth in subsection A of this section, unless the industrial user holds more than one such right or permit in the aggregate amount of more than 10 acre-feet per year and withdraws more than 10 acre-feet of water during the calendar year pursuant to those rights or permits.

6-204. Remediated Groundwater Accounting for Conservation Requirements

A. Accounting

Groundwater withdrawn pursuant to an approved remedial action project under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, and used by a person subject to a conservation requirement established under this chapter shall be accounted for consistent with the accounting for surface water for purposes of determining the person's compliance with the conservation requirement, subject to the provisions of subsections B through D of this section.

B. Amount of Groundwater Eligible for Accounting

For each approved remedial action project, the annual amount of groundwater that is eligible for the remediated groundwater accounting provided in subsection A of this section is the project's annual authorized volume. The annual authorized volume for a remedial action project approved on or after June 15, 1999 is the maximum annual volume of groundwater that may be withdrawn pursuant to the project, as specified in a consent decree or other document approved by the United States Environmental Protection Agency (EPA) or the Arizona Department of Environmental Quality (ADEQ). The annual authorized volume for a project approved after June 15, 1999 is the highest annual use of groundwater withdrawn pursuant to the project prior to January 1, 1999, except that if a consent decree or other document approved by the EPA or ADEQ specifies the maximum annual volume of groundwater that may be withdrawn pursuant to the project, the project's annual authorized volume is the maximum annual volume of groundwater specified in that document. The director may modify the annual authorized volume for a remedial action project as follows:

1. *For an approved remedial action project associated with a treatment plant that was in operation prior to June 15, 1999, a person may request an increase in the annual authorized volume at the same time the notice is submitted pursuant to subsection C of this section. The director shall increase the annual authorized volume up to the maximum treatment capacity of the treatment plant if adequate documentation is submitted to the director demonstrating that an increase is necessary to further the purpose of the remedial action project and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.*

2. *A person may request an increase in the annual authorized volume of an approved remedial action project at any time if it is necessary to withdraw groundwater in excess of the annual authorized volume to further the purpose of the project. The director shall increase the annual authorized volume up to the maximum volume needed to further the purpose of the project if adequate documentation justifying the increase is submitted to the director and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.*

3. *The director shall modify the annual authorized volume of an approved remedial action project to conform to any change in the consent decree or other document approved by the EPA or ADEQ if the person desiring the modification gives the director written notice of the change within thirty days after the change. The notice shall include a copy of the legally binding agreement changing the consent decree or other document approved by the EPA or ADEQ.*

C. Notification

To qualify for the remediated groundwater accounting provided in subsection A of this section, the person desiring the accounting must notify the director in writing of the anticipated withdrawal of groundwater pursuant to an approved remedial action project under CERCLA or Title 49, Arizona Revised Statutes, prior to the withdrawal. At the time the notice is given, the person desiring the accounting must be using remediated groundwater pursuant to the approved remedial action project or must have agreed to do so through a consent decree or other document approved by the EPA or ADEQ. The notice required by this subsection shall include all of the following:

1. *A copy of a document approved by ADEQ or the EPA, such as the Remedial Action Plan (RAP), Record of Decision (ROD) or consent decree, authorizing the remediated groundwater project. Unless expressly specified in the document, the person shall include in the notice the volume of groundwater that will be pumped annually pursuant to the project, the time period to which the document applies, and the annual authorized volume of groundwater that may be withdrawn pursuant to the project.*

2. *The purpose for which the remediated groundwater will be used.*

3. *The name and telephone number of a contact person.*

4. *Any other information required by the director.*

D. Monitoring and Reporting Requirements

To qualify for the remediated groundwater accounting for conservation requirements as provided in subsection A of this section, groundwater withdrawn pursuant to the approved remedial action project must be metered separately from groundwater withdrawn in association with another groundwater withdrawal authority for the same or other end use. A person desiring the remediated groundwater accounting for conservation requirements shall indicate in its annual report under A.R.S. § 45-632 the volume of water withdrawn and used during the previous calendar year that qualifies for the accounting.

6.3 TURF-RELATED FACILITIES

6.3.1 Introduction

A turf-related facility is a facility with 10 or more acres of water-intensive landscaped area. Golf courses, parks, schools, cemeteries, and common areas within residential developments are examples of facilities that often qualify as turf-related facilities. Because "irrigation" is defined in the Code as water applied for the purpose of growing crops for sale or consumption, turf-related watering for recreational and aesthetic purposes is considered a non-irrigation water use rather than an irrigation use.

Turf-related facilities regulated under the Industrial Conservation Program obtain water pursuant to Type 1 or Type 2 non-irrigation grandfathered rights or groundwater withdrawal permits. In addition, a large number of turf-related facilities are served water by municipal water providers and are also subject to the conservation requirements set forth in this section through provisions of the Municipal Conservation Program (see Chapter 5). These municipally-served facilities are called individual users.

Second Management Plan conservation requirements and other factors have led to changes in turf-related facilities. New facilities are typically designed with less water-intensive acreage, both existing and new facilities employ technology that applies water more efficiently, and facility management has become more cognizant of the need for water conservation.

6.3.2 Water Use by Turf-Related Facilities

Turf-related facilities apply water for growing turfgrass and other landscaping plants and for filling and maintaining water levels in bodies of water. Water application efficiency is determined by the type of water application system that is utilized, maintenance of the system, water application scheduling, site topography, soil type, weather conditions, and water quality. There are four turf-related facilities in the Santa Cruz AMA, all of which are golf courses.

There is a direct relationship between the number of acres of water-intensive landscaping maintained within a facility and the facility's water use. In 1995, turf-related facilities in the Santa Cruz AMA encompassed a total of 460 acres of turf and just under 10 acres of water surface area. From 1987 through 1995, the average annual water use per acre of turf within turf-related facilities has ranged between 2.2 and 4.9 acre-feet per acre. This range is indicative of the broad spectrum of water management practices, changes in application rates based on weather patterns and changes in facility design, including removing or installing additional turf, low water use and water surface acres.

The water use rate for maintaining bodies of water is higher than for turf and low water use landscaping because evaporation from the water surface (between 5 and 6 acre-feet per acre year) is higher than the consumptive use and evaporation rates for plants. Unlined or inadequately sealed water holding basins can lose significant volumes of water through seepage. The bodies of water associated with golf courses are generally used as an integral part of the course design and as a holding basin for water used for turf-related watering.

Turf-related facility water use in the Santa Cruz AMA has fluctuated over time probably mostly due to increased or decreased watering based on weather conditions. In 1992, a year that was cooler and wetter than average, the four turf-related facilities in the AMA used a total of 1,338 acre-feet. In contrast, about 2,244 acre-feet were used by these facilities in 1989, a year that was hotter and drier than average.

Turf-related facility water demand in the Santa Cruz AMA is met either through a non-irrigation grandfathered right or service from a municipal water provider. Two golf courses, Palo Duro (previously called Meadow Hills) and Kino Springs, are served water from the City of Nogales. The other two courses, Rio Rico and Tubac Ranch Resort, are served using their own non-irrigation grandfathered rights.

Annual water demand by turf-related facilities will increase if new golf courses are constructed within the AMA, and demand will continue to fluctuate with weather conditions even if no new courses are built. Golf courses are the most likely kind of turf-related facility that may be constructed. Most schools that are built in the AMA have less than 10 acres of turf, and it is unlikely that a park will be built in this AMA containing more than 10 acres of turf. The Santa Cruz AMA has no information on whether a new cemetery may be constructed, but it is unlikely that this will occur for some time.

The gallons per capita per day rate of a municipal water provider usually increases if it begins serving a new turf-related facility. This may cause a conservation requirement compliance problem for the provider. A new turf-related facility could use some of the unused non-irrigation grandfathered right allotment in the AMA. Increased volume of water withdrawn from wells to serve a new turf-related facility that is not offset with replenishment could result in a long-term decline in local water table levels and impact the AMA's ability to maintain safe-yield conditions.

6.3.2.1 Golf Courses

In the Santa Cruz AMA, golf courses include 18-hole facilities. Golf courses are composed of tees, greens, fairways, and roughs. The most frequently used types of warm season grass are common or hybrid bermuda grass (*Cynodon*) with hybrid bermuda or bent grass (*Agrostis*) used primarily on greens. Rio Rico and Tubac Ranch Resort golf courses routinely overseed in winter months. Typically golf courses overseed their tees and greens with rye grass (*Lolium*) in winter unless they have bentgrass greens. Palo Duro and Kino Springs have not extensively overseeded their courses in the past.

Statewide, a high proportion of resort golf courses overseed at least the fairways during the winter months. There is a great deal of variability in overseeding patterns on public and private courses. Some courses prefer to avoid the expense, maintenance problems and stress to the turf associated with overseeding fairways. Some golfers appreciate the better playability associated with dormant bermuda grass. Other facility managers feel strongly that a green appearance during the winter months is required to attract visitors to golf courses in Arizona. There is strong interest in turf appearance for all golf courses, particularly resort courses and courses associated with housing developments which emphasize aesthetics rather than maximum playability and water conservation during the winter.

Golf course water application systems are often more sophisticated than those at parks, schools or cemeteries. Many golf courses have a system with a control panel and field satellites that can override the central controller. Computer-controlled watering systems and pump stations with flexibility in operating sprinkler heads are commonplace; newer systems provide much greater savings in energy and water costs than water delivery systems of 10 years ago. Most of the newer systems can incorporate weather stations which assist in scheduling water application to more accurately replace the amount of water lost through evaporation and transpiration. Most courses apply water to greens and tees with spray heads; larger turf areas are watered with large radius heads. Water is typically pumped into the watering system from a reservoir or a storage tank.

Turf managers who are knowledgeable of water conservation technologies and practices are critical to program effectiveness. Taking advantage of a computerized system's ability for field-adjusting water distribution uniformity or the percentage of points within the area being watered which receive equivalent amounts of water, routine leveling of heads, and frequent verification of proper operation of all controllers and heads are examples of prudent management.

The four golf courses in the Santa Cruz AMA used just under 1,600 acre-feet of water in 1995. Almost 1,100 acre-feet of this was withdrawn pursuant to non-irrigation grandfathered rights. This use was 78 percent of the total water withdrawn pursuant to non-irrigation rights and permits within the Santa Cruz AMA in 1995.

6.3.2.2 Schools

Although there are no schools in the Santa Cruz AMA currently that have more than 10 acres of turf, there are two schools in the AMA that withdraw water from a right or permit for turf-related watering. These schools used a total of 14.6 acre-feet of water in 1995 in the Santa Cruz AMA. The main function of turf in school yards is to provide an appropriate surface for active play. Turf appearance is not as major a concern for schools and parks as it is for cemeteries and golf courses. Many school managers have determined that using low water application rates can save money without adversely impacting turf use.

Water application systems at schools are usually relatively inflexible. In older schools, outdated equipment, including quick coupler systems, is common. Newer facilities have in-place heads with manual or electromechanical control. Some schools have converted non-play areas to drip irrigation. Due to budget constraints, it is difficult for schools to install computerized controllers and systems are frequently manually operated.

In the Santa Cruz AMA, several schools that have less than 10 acres of turf are believed to be using water inefficiently and may become involved in non-regulatory efforts aimed at improving efficiency during the third management period. Since these schools are too small to be regulated, their water use has not been separated out from total municipal use. These schools are served by municipal providers and therefore are not included in total industrial water use for the AMA.

6.3.3 First and Second Management Plan Program Development

The First Management Plan established a maximum annual water allotment for each turf-related facility and stressed water use efficiency. This was the first time golf course water use was regulated, and water management practices such as evapotranspiration-based water application scheduling was uncommon. The First Management Plan provided for adjustment of turf application rates if effluent was used.

The allotment approach permitted turf managers to consider characteristics of the facility, evaluate conservation alternatives, and decide how to most effectively apply the allotment to meet the facility's needs. A golf course requiring a lush, green appearance during the winter season could choose to reduce the amount of water applied to bermuda grass through the summer season, making a larger portion of the allotment available for extensive cool-season overseeding. Conversely, a golf course could emphasize the playability and lower maintenance of dormant bermuda grass and apply more of the allotment and maximize bermuda grass appearance during the summer season. A golf course which demanded a year-round lush appearance received sufficient allotment to do so if state-of-the-art water application technologies and water management practices were employed.

Development of the Second Management Plan conservation requirements involved extensive data collection regarding water use patterns in Arizona and the conservation options available to turf-related facility managers. The Department relied heavily on input from the Turf Advisory Committees in the Tucson and Phoenix AMAs, which consisted of golf course, park, cemetery, and school turf managers, turf irrigation specialists, extension agents, and golf course designers.

The Department used consulting services to analyze the water conservation practices in use in the turf industry and the potential for future water conservation. The study evaluated technologies, including management practices and design alternatives associated with water conservation. A primary finding of the study was that management of the water application system, rather than the use of specific water application systems, is the most important factor in efficient landscape watering. The consultant and advisory committees concluded that a combination of good management and use of the latest water application systems was very effective in reducing water use.

For the Second Management Plan, the Department chose not to require specific conservation techniques wherever possible due to the widely varied nature of turf-related facilities. Instead, turf-related facilities continued to receive a maximum annual water allotment based on the use of conservation techniques. The allotment approaches of the First and Second Management Plans permitted turf managers to consider characteristics of the facility, evaluate conservation alternatives, and decide how to most effectively apply the allotment to meet each facility's needs.

The Second Management Plan included an overall decrease in application rates for all turf-related facilities, caps on maximum annual water allotments for new golf courses, and a limitation on the water-intensive landscaped area within new cemeteries, plus a more specific effluent incentive. In setting the annual water allotments, factors considered included actual water use figures collected from over 400 turf-related facilities in all AMAs. Data on the consumptive use of the grass species most frequently used; water application efficiency achievable with available technologies; evaporative losses from bodies of water based on pond evaporation data; management practices and technologies currently in place; conservation potential associated with additional technologies, practices, and design alternatives; and germination requirements for establishing new turf were compiled and analyzed.

Based on these factors, the Department established final annual application rates in the Tucson AMA, which the Santa Cruz AMA was part of at that time, of 4.6 acre-feet per acre for turf acres, 5.8 acre-feet per acre for bodies of water and 1.5 acre-feet per acre for low water use landscaping. For golf courses that came into existence after 1984 the maximum annual water allotment could not exceed 23.8 acre-feet per hole. Adjustments to the application rates were provided for establishing new turf, using high salinity water, filling or refilling bodies of water, and revegetating acreage disturbed during construction.

The Department continued to encourage the use of effluent in the Second Management Plan. As an incentive, effluent use, if 50 percent or more of total water use, was discounted when determining a facility's compliance with its maximum annual water allotment.

A review of short-term weather data in the 1980s indicated that a three-year averaging method would adequately compensate for weather fluctuations when determining a facility's compliance with its allotment. A provision for finding a facility in compliance on either an annual or a three-year average basis was included in the Second Management Plan.

6.3.4 Issues and Third Management Plan Development

The Code provides that the conservation program for industrial users shall require the use of or establish conservation requirements based on the use of the latest commercially available and economically feasible water conservation technologies. For turf-related facilities, such technologies include: (1) the use of weather-based water application scheduling and water budgeting; (2) accurate, well-designed water application systems and computerized control mechanisms; (3) golf course design which concentrates water-intensive landscaping in areas which come into play; and (4) PVC liners for bodies of water. Using new low water use and drought tolerant turfgrasses, improving conservation knowledge and awareness by facility management, and converting industrial users to renewable supplies are ways turf-related facilities could reduce their water demand and assist in maintaining safe-yield conditions and preventing long-term declines in local water table levels.

TACs, consisting of golf course, park, school, and cemetery turf managers, golf course directors, golf course architects, industry association representatives, and land developers, have contributed to the development of the Third Management Plan conservation program for turf-related facilities. The committees aided the Department in identifying second management period water use efficiency, water supply and conservation program effectiveness issues, provided and reviewed data and information relevant to the issues, and participated in developing program alternatives for the third management period. The committees worked with the Department to review the merits of all alternatives and to strive for consensus on the program for the third management period. In some cases, subcommittees were formed to address a specific issue and to make a program recommendation to the committee as a whole. In the Santa Cruz AMA, the GUAC was briefed periodically on the development of the plan and issues identified. These committees and the Department identified the following issues of relevance:

- the allotment methodology
- application rates for turf
- weather adjustment
- renewable supply incentives

6.3.4.1 Allotment Methodology and Application Rates

The Second Management Plan final annual application rates of 4.6 acre-feet per acre for turf acreage, 5.8 acre-feet per acre for bodies of water, and 1.5 acre-feet per acre for low-water use landscaping applied to all turf-related facilities. However, for most golf courses constructed after 1984, the maximum annual water allotment was limited to 23.8 acre-feet per hole.

During Third Management Plan development, some representatives of the golf industry argued that the Second Management Plan application rates for turf and the cap on the allotment for golf courses constructed after 1984 denied golf courses their legal right to sufficient water to meet their actual needs consistent with their selected business practices. They felt that the Department's program unreasonably prevented the complete overseeding of golf courses, interfered with reasonable management of longer courses needed to attract high-visibility tournaments, and resulted in target-style courses which imposed unreasonable skill demands on inexperienced and older golfers. They asserted that the allocations were not supported by sufficient data. Other TAC members felt that Second Management Plan application rates and allotment limitations were supported by scientific research and, that while potentially challenging to superintendents and designers, the allotments were adequate assuming the use of high-quality water application systems and conscientious water management practices.

Factors influencing turf watering needs include temperature, solar radiation, humidity, wind, and soil moisture. Based on research conducted at the University of Arizona Desert Turf Research Center (Brown, Gilbert, and Kopec, 1996) and 1988 to 1996 weather data from the Arizona Meteorological Network (AZMET) Tucson Station, high-quality turf with winter overseeding would need 4.5 to 5.2 acre-feet per acre per year of applied water depending upon the weather conditions of that year, not including rainfall. This research supports the adequacy of the Second Management Plan's 4.6 acre-feet per acre per year application rate for maintaining overseeded turf.

The parameters assumed in the research are conditions that may lead to a long-term root zone salt accumulation, depending upon the quality of the water applied to turf. Additional investigation is needed to determine if typical rainfall distribution will adequately flush accumulated salts beyond the turfgrasses' root zone, if rainfall is not sufficient, or if continuous water application at a slightly higher rate or periodic flushing at a much higher application rate would best balance salt management and water application efficiency.

Because regional variation in rainfall, wind speed during watering times, soil type, root zone depth, and course topography can all have potential negative impacts on turf water demand, application rates deemed sufficient for the majority of facilities may not be appropriate for all facilities. Individual facilities with special circumstances which could render these application rates unreasonable may seek relief through administrative review. A.R.S. § 45-575.

While the maximum annual water allotment provisions do not directly limit water-intensive acreage of new golf courses, acreage limitations are incorporated into the derivation of the 23.8 acre-foot per hole allotment cap. Among the conservation technologies currently available to golf course developers, minimizing water-intensive acreage is one of the most effective means of reducing water demand. Both the turf-related facility study conducted by the Department during development of the Second Management Plan and numerous articles in golf industry trade journals during the past 15 years point to smaller turfed areas as an effective means for golf courses to save water and reduce operating costs. Eighteen-hole golf courses with about 90 acres of turf were found to be more manageable while still being around 7,200 yards in length. Bodies of water with two to three acres of surface area allow for sufficient storage capacity to hold three to five days worth of peak facility water demand. The allotment cap is based on these acreage guidelines for an 18-hole course multiplied by the application rates for turfed and water surface area, expressed on a per hole basis.

Historic water use and research in California indicates that the higher unirrigated perimeter to turfed acre ratios typical of target-style courses may result in higher water demand per acre than that of more traditionally-designed courses. Increased evapotranspiration may occur within 200 feet of perimeters adjacent to unwatered or low water use areas. On narrow fairways these zones may coincide, and water demand for the entire turfed area may increase on the order of 5 percent. In order to quantify this effect for possible inclusion in management plan requirements, additional research needs to be conducted in the desert regions of Arizona.

6.3.4.2 Weather Adjustment

Long-term weather data indicate that the mid-1980s and early 1990s represented a comparatively "wet" period. Historically, rainfall in the Santa Cruz AMA tends to be cyclic with "dry" or "wet" periods that may last as long as four or five years. Wet years early in the second management period were followed by a protracted period of hot summer weather combined with sparse or late summer rains.

Alternatives were considered to the three-year averaging approach for determining compliance used in the Second Management Plan in order to compensate for weather fluctuations more effectively. These alternatives included a flexibility account and a five-year averaging provision. For the Third Management Plan, the Department chose not to extend the three-year averaging provision to five years. The length of a five-year averaging provision would result in a considerable lag between the time the annual allotment was exceeded and when corrective action could be taken. Instead, the Department opted for a flexibility account that contains both credit and debit limits. Credit and debit limits for the flexibility account have been set at 20 percent of the maximum annual water allotment based on an analysis of the 1988 through 1997 weather variations. The account will encourage and reward careful management through the accrual of credits.

6.3.4.3 Renewable Supply Incentives

Existing industrial users continue to pump water. Conservation requirements strive for efficient use, but do not address the balance that must be maintained between water demands and supplies, nor local water table levels. The availability of Type 2 non-irrigation grandfathered rights through sale or lease, the conversion of irrigation rights to Type 1 non-irrigation grandfathered rights, the issuance of groundwater withdrawal permits, and the delivery of water by municipal water providers are all prospects which could increase water withdrawn from wells by turf-related facilities in the future. This situation could potentially have a negative impact on the maintenance of safe-yield and the prevention of long-term declines in local water table levels unless water management programs provide a mechanism to offset these increases in demand.

In the Second Management Plan, the effluent use incentive was structured so that if at least 50 percent of a facility's applied water was effluent, the volume of effluent used was discounted. The amount of the discount was 5 percent if up to 89 percent of the total water use was effluent and 10 percent if 90 percent or more of the total water use was effluent. Also, the cap placed on the allocation given for bodies of water within new golf courses did not apply to bodies of water filled entirely with effluent.

The Department and the Third Management Plan Turf TACs discussed several incentives that would further encourage effluent utilization by both municipally provided facilities and industrial users in the Third Management Plan. Because effluent is an underutilized supply, the Department chose to discount all direct effluent use by 30 percent. The discount provides an increased incentive to encourage effluent use where supplies are expensive and may encourage the construction of wastewater treatment plants to produce effluent in new developments, where supplies may be limited until residential development nears completion. The incentive acknowledges the need for efficient use of all water supplies, while providing a higher potential application rate to facilities using higher percentages of effluent. Agronomic research has shown that high quality turfgrass can be maintained through application of approximately 75 percent of the measured evapotranspiration rate. As effluent use approaches 100 percent of a facility's total water use, the 30 percent effluent discount will allow a typical golf course to apply the full amount of water lost by turfgrass through evaporation and transpiration.

The Department and the TACs also explored options to allow a turf-related facility to mitigate water use in excess of the annual water conservation allotment. If a turf-related facility exceeds its maximum debit limit, it could be asked to replenish more than the excess without earning credits (known as storing "non-recoverable" water) or extinguishing any existing recharge credits at a higher rate than the excess water used at the facility. Issues considered included the rates of recharge required, conditions that would apply to ensure no wasteful practices are condoned, the effect on water conservation efforts, and the effect of excessive pumping upon localized hydrologic conditions. For the Santa Cruz AMA, the option of replenishing more than the excess will need to be further evaluated for benefits to the AMA and its affects on water users.

The Department determined that the replenishment option will not be included as a part of the conservation requirements for turf-related facilities during the third management period. In the meantime, the option of extinguishing recharge credits or storing non-recoverable water in particular areas as a compliance mechanism will be considered during the third management period, even in advance of a violation. Owners and operators of turf-related facilities who anticipate an allotment violation are encouraged to develop a proactive response program in cooperation with the Department (see Chapter 10).

6.3.5 Turf-Related Facilities Program

6.3.5.1 Maximum Annual Water Allotment

6.3.5.1.1 Base Allotment

The core of the conservation program for turf-related facilities is the maximum annual water allotment. The allotment is calculated differently for different types of facilities, but generally there is a direct relationship between the number of acres to which water is applied and the volume of the allotment. For all turf-related facilities, the annual application rate for turf acres is 4.6 acre-feet per acre, the application rate for water surface acres is 5.8 acre-feet per acre, and the application rate for low water use landscaped area is 1.5 acre-feet per acre.

For turf-related facilities other than golf courses, the allotment is calculated by determining the actual acreage within the facility in each of the three landscaping categories and then multiplying the number of acres by the appropriate application rate. The approach used for these facilities allows expansion of landscaped area. Beginning with the First Management Plan, the Department recognized that the latest conservation technology for golf courses includes course design which concentrates water-intensive landscaping into areas which come into play and water management practices which adjust water application schedules for weather conditions and seasons of highest play. The allotment for golf course acreage which came into existence after December 31, 1984 is therefore capped to encourage efficient design, construction, water application, and overseeding practices. These caps are described below.

Golf course acreage that came into existence from January 1, 1985 through December 31, 1991- For golf courses, the allotment for any turf acres that came into existence from January 1, 1985 through December 31, 1991 is limited to an amount calculated by multiplying the number of holes within those acres by 23 acre-feet of water per hole, plus any allotment additions described later in this section. This cap is sufficient to water 5 acres of turf at 4.6 acre-feet per acre. If the turf acres planted during that period are in fact limited to 5 acres per hole, there is no cap on the allotment for any bodies of water that came into existence within the facility from January 1, 1985 through December 31, 1991. However, if the turf acres planted from January 1, 1985 through December 31, 1991 exceed 5 acres per hole, the allotment for any bodies of water that came into existence during that period and that are not filled and refilled entirely with direct use effluent is limited to an amount calculated by multiplying the number of holes within those turf acres by 0.8 acre-feet of water, plus any allotment additions described later in this section.

Golf course acreage that came into existence after December 31, 1991 - For golf courses, the total allotment for turf acres, and low water use landscaped area that came into existence after December 31, 1991 is limited to an amount calculated by multiplying the number of holes within those acres by 23 acre-feet of water, plus any allotment additions described later in this section. This cap is sufficient to water 5 acres of turf at 4.6 acre-feet per acre. If less than five acres of turf are planted per hole, the cap allows sufficient water for approximately 3 acres of low water use landscaping in place of each acre of turf not planted. The allotment for all bodies of water that came into existence after December 31, 1991 and that are not filled and refilled entirely with effluent is limited to an amount calculated by multiplying the number of holes within the turf acres that came into existence during that period by 0.8 acre-feet of water. This cap limits the allotment for such bodies of water to 0.14 acre of water surface per hole.

Golf courses may expand or develop any number of water-intensive landscaped acres and low water use landscaped area. However, water use must not exceed the maximum annual water allotment, which assumes acreage restrictions. Although the allotment is calculated on a per acre basis, the facility manager has discretion on how to apply the allotment within the facility.

6.3.5.1.2 Allotment Additions

Under certain circumstances, a turf-related facility is entitled to an addition to its base allotment. In some cases, the allotment addition is effective only for one year; in other cases, the allotment addition is effective for a longer period. The following are the allotment additions allowed in the Third Management Plan.

Reduction of Turfed Acreage

Conservation requirements for the third management period continue to provide an incentive to reduce landscaped area. When calculating the maximum annual water allotment for a turf-related facility, the amount of water allotted to pre-1985 turf, water surface acres, and low water use landscaping is based on the highest number of those acres in existence at the facility during the period from 1980 through 1984. Thus, removal of acreage planted during that period will not decrease the facility's allotment. All turf-related facilities are encouraged to minimize the water-intensive landscaping to areas consistent with the intended use and enjoyment of the facility.

Allotment Addition for Establishment of Newly Turfed Area

An allotment addition is given to turf-related facilities for the establishment of newly planted turf. The allotment addition is equal to 1.0 acre-feet per acre of newly turfed area, and is limited to the year in which the turf is planted. For golf courses, the allotment addition is limited to an amount calculated by multiplying the number of holes present within the newly turfed area by 5 acre-feet of water.

Allotment Addition for Revegetation

A revegetation allotment addition is available to facilities that want to establish low water use or other site-adapted landscaping plants which will need only temporary supplemental water application after construction of a new or renovated facility. This allotment addition of up to 1.5 acre-feet per acre for up to a maximum of three calendar years, is quantified and granted on an individual basis through an application process. The quantity and duration of the allotment adjustment is determined through the Department's evaluation of each application. This adjustment is separate from the low water use landscaping component included in the maximum annual water allotment calculation and is not included in the allotment cap for new landscaped areas within golf courses.

Allotment Addition for Filling Bodies of Water

New turf-related facilities receive a one-time allotment addition to fill bodies of water within the facility. The allotment addition is equal to the volume used for initial filling of the body of water and is given only for the year in which the body of water is filled. Any facility may also apply for an allotment addition to refill a body of water which has been emptied for maintenance work to eliminate or reduce seepage losses. The allotment addition may be given only for the year in which the body of water is refilled.

Allotment Addition for Leaching

When high levels of total dissolved solids are present in the water supply, a turf-related facility may need an additional amount of water for leaching or deep percolation to prevent salts from accumulating in the root zone. If salts are allowed to accumulate in the soil, salinity may eventually reach levels toxic to turfgrass. Since most water supplies in the Santa Cruz AMA are of a quality which does not require an additional leaching allowance, a leaching allowance was not included in the maximum annual water allotment calculation. However, if a facility's water supply has a concentration of 1,000 milligrams per liter of total dissolved solids (approximately 1.5 millimhos per centimeter of electrical conductivity) or greater, the turf-related facility may apply to the Department for an allotment addition for leaching.

6.3.5.2 Additional Conservation Requirements

All turf-related facilities are required to prepare and maintain a water conservation plan. The plan must outline the water management practices and technologies the facility will utilize to maximize water use efficiency. All turf-related facilities that are not golf courses are required to design, construct, and maintain grounds in a manner which will minimize water-intensive landscaped areas consistent with reasonable use and enjoyment of the facility. Golf courses have a capped maximum annual allotment which assumes water-efficient design and management.

A turf-related facility that is a cemetery must limit the water intensive landscaped area within any portion of the cemetery that came into existence after December 31, 1991, so that no more than 75 percent of the total cemetery area within that portion of the cemetery is landscaped with plants not listed on the Low Water Use/Drought Tolerant Plant List for the Santa Cruz AMA (see Appendix 5B). This restriction does not apply to an expansion of a cemetery onto contiguous land that was under the same ownership as the cemetery as of December 31, 1984.

6.3.5.3 Effluent Use Adjustment

In the Santa Cruz AMA, effluent is the only water supply which is expected to increase in availability throughout the third management period. Effluent's high nutrient content makes it an excellent supply for turf-related watering, as long as the nutrient load is carefully matched to plant needs and over-application is avoided. Despite the availability and suitability of effluent for turf watering, effluent is currently underutilized as a source of water for turf-related facilities.

To encourage the maximum use of effluent on turf-related facilities during the third management period, the Department has modified the effluent incentive offered in the Second Management Plan. While the maximum annual water allotment will not change, each acre-foot of effluent will be counted as 0.7 acre-foot when compliance with the maximum annual water allotment is determined. This adjustment does not apply to effluent stored in a storage facility pursuant to a water storage permit and recovered outside the area of impact of the stored water. In addition to the effluent adjustment, facilities using effluent may apply to the Department for an allotment addition to allow for leaching of salts below the root zone.

6.3.5.4 Flexibility Account

In order to compensate for fluctuating weather conditions, each turf-related facility will have a flexibility account with credit and debit limits. In wetter years or through careful management, facilities will be able to accrue a credit balance up to 20 percent of a facility's annual allotment. When weather conditions or water management decisions cause a facility's water use to exceed its allotment in any year, accrued credits are expended. If all credits are exhausted, a facility may accrue a debit balance up to 20 percent of the allotment. A violation will occur only when all credits have been exhausted and the debit maximum is exceeded. Prudent facility managers will take advantage of wet years and the latest conservation technologies to accumulate as many credits as allowed in order to compensate for fluctuations in water demand during hot or dry years.

6.3.5.5 Monitoring and Reporting Requirements

The Third Management Plan includes monitoring and reporting requirements for all turf-related facilities. All turf-related facility water use will be assumed to be for landscape watering purposes unless other water uses are metered separately. For example, if water for a club house is not separated from water used for turf-related watering, it will count against the facility's allotment. This provision encourages facilities to install enough meters to ensure that turf-related watering is accurately measured and reported.

6.3.6 Non-Regulatory Efforts

In 1991, the Department initiated a grants program for conservation assistance and augmentation of water supplies in the AMAs. Individual AMA programs focus on the areas of highest water conservation potential in each water use sector (municipal, industrial, and agricultural) based on total water usage, current water usage practices, and potential for implementation of new conservation technologies. Funding for the program comes from an annual withdrawal fee levied and collected from all regulated water users in the AMAs. See Chapter 9 for a description of the Conservation Assistance Program for the third management period.

6.3.7 Future Directions

A significant increase in the volume of water withdrawn from wells, particularly in the Younger Alluvium of the Santa Cruz River, may prevent the maintenance of safe-yield conditions and result in long-term declines in local water table levels. The current Code provisions will probably need to be modified to allow the Santa Cruz AMA to manage for its dual goals. Management plan conservation requirements can reduce the withdrawal of water from wells only to the extent that the requirements are consistent with reasonable economic return. Absent additional legislation specifically addressing the appropriateness of using high-quality pumped water for turf-related watering, the management plans can only require water use efficiency that is economically justified. Direct utilization of effluent combined with efforts to maximize water application efficiency are currently the key factors in meeting the AMA water management goals. A management plan modification is anticipated in the Santa Cruz AMA. The modification is expected to provide additional water management tools including both demand and supply components.

The relationship of turf-related watering to the maintenance of safe-yield and the prevention of long-term declines in local water table levels must be evaluated and quantified. Some component of applied water may actually be incidentally recharged. Deep percolation of water which may contain fertilizers and other horticultural chemicals could reduce water quality.

Stronger conservation-oriented technology and water management practice requirements should be considered from both a regulatory and non-regulatory approach. From a regulatory perspective, application rates which determine the maximum annual water allotments need to be further scrutinized under actual field conditions. Conservation technologies and practices should be further evaluated as a regulatory alternative to enforceable allotments. From a non-regulatory approach, legislation that increases funding for conservation, education, and augmentation could assist turf managers with water management practices, evaluation of effective water conservation technology, and construction of effluent conveyance infrastructure.

6.3.8 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Turf-Related Facilities

6-301. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, and section 6-201 of this chapter, the following words and phrases used in sections 6-301 through 6-305 of this chapter, unless the context otherwise requires, shall have the following meanings:

1. *"Body of water" means a constructed body of water or interconnected bodies of water, including a lake, pond, lagoon, or swimming pool, that has a surface area greater than 12,320 square feet when full and that is filled or refilled primarily for landscape, scenic, recreational purposes, or regulatory storage.*

2. *"Common area" means an area or areas which is owned and operated as a single integrated facility and which is used for recreational or open space purposes. A common area is maintained for the benefit of the residents of a housing development.*

3. *"Contiguous" means in contact at any point, or part of the same master planned community. Two parcels of land are contiguous even if they are separated by one or more of the following: a road, easement or rights-of-way.*

4. *"Direct use effluent" means effluent transported directly from a facility regulated pursuant to Title 49, Chapter 2, Arizona Revised Statutes, to an end user. Direct use effluent does not include effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes.*

5. *"Effluent recovered within the area of impact" means effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes, and recovered within the stored effluent's area of impact. For purposes of this definition, "area of impact" has the same meaning as prescribed by A.R.S. § 45-802.01.*

6. *"First management period new acres" means a water-intensive landscaped area or a low water use landscaped area which came into existence or was substantially commenced after December 31, 1984 and before January 1, 1992, but which was not substantially commenced prior to January 1, 1985.*

7. *"First management period new turf acres" means turf acres which came into existence or were substantially commenced after December 31, 1984 and before January 1, 1992, but which were not substantially commenced prior to January 1, 1985.*

8. *"Golf course" means a turf-related facility used for playing golf with a minimum of nine holes and including any practice areas.*

9. *"Hole" means a component of a golf course consisting at a minimum of a tee and a green. A practice area or driving range is not a hole.*

10. *"Landscape watering" means the application of water from any source, including effluent, to a water-intensive landscaped area, a low water use landscaped area, or revegetation acres within a turf-related facility.*

11. *"Low water use landscaped area" means an area of land of at least one acre in aggregate, which is an integral part of a turf-related facility, which is watered by a permanent water application system and which is planted primarily with plants listed in Appendix 5B, Low Water Use/Drought Tolerant Plant List, or any modifications to the list. Mature vegetation planted in a low water use landscaped area must cover at least 50 percent of the area.*

12. *"Newly turfed area" means, for a calendar year, an area of land planted with a warm-season grass species which was not planted with a warm-season grass species during the preceding calendar year.*

13. *"Overseeded area" means, for a calendar year, an area of land planted with any cool-season grass species that grows over a dormant warm-season grass species during the fall-winter period.*

14. *"Post-1991 acres" means a water-intensive landscaped area or a low water use landscaped area which was neither in existence nor was substantially commenced as of December 31, 1991.*

15. *"Pre-1985 acres" means a water-intensive landscaped area or a low water use landscaped area which was either in existence or was substantially commenced as of December 31, 1984.*

16. *"Substantially commenced" means that all pre-construction permits and approvals required by federal, state, or local governments have been obtained or substantial capital investment has been made in the physical on-site construction.*

17. *"Total cemetery area" means an area of land being used for cemetery-related purposes, including any area of land covered by grave markers or by cemetery-related buildings, walks, pathways, and landscaping, but not including roads, parking lots, and any areas of land being held for future expansion of the cemetery.*

18. *"Turf acres" means an area of land that is watered with permanent water application system and planted primarily with plants not listed in Appendix 5B, Low Water Use/Drought Tolerant Plant List, or any modifications to the list.*

19. *"Turf-related facility" means any facility, including cemeteries, golf courses, parks, schools, or common areas within housing developments, with a water-intensive landscaped area of 10 or more acres. Turf-related facilities include, but are not limited to, those facilities listed in Appendix 6.*

20. *"Water-intensive landscaped area" means, for a calendar year, the turf acres and the water surface acres within a turf-related facility.*

21. *"Water surface acres" means the total surface area of all bodies of water that are an integral part of the water-intensive landscaped area of a turf-related facility. Bodies of water used primarily for swimming purposes are not an integral part of the water-intensive landscaped area of a turf-related facility.*

6-302. Conservation Requirements for Turf-Related Facilities

A. Maximum Annual Water Allotment

Beginning with calendar year 2002 or the calendar year in which landscape watering commences, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, an industrial user who uses water at a turf-related facility shall not withdraw, divert, or receive water for landscape watering purposes at the facility during a calendar year in an amount which exceeds the turf-related facility's maximum annual water allotment for the year as calculated in section 6-303 below.

B. Conservation Plan

No later than January 1, 2002 or 180 days after receiving official notice of conservation requirements, whichever occurs later, an industrial user who uses water at a turf-related facility shall have prepared a conservation plan for the facility which contains an accurate and detailed description of the conservation technologies, including management practices, that are applied at the facility when water is used for landscape watering purposes. The industrial user shall maintain the conservation plan until the first compliance date for any substitute requirement in the Fourth Management Plan.

C. Limiting Water-Intensive Landscaped Area

1. *Beginning on January 1, 2002 or upon commencement of landscape watering, whichever occurs later, and continuing until the first compliance date for any substitute requirement in the Fourth Management Plan, an industrial user who uses water at a turf-related facility that is not a golf course or a cemetery shall design, construct, and maintain the grounds of the facility in a manner which minimizes the water-intensive landscaped area of the facility consistent with the use of the facility. All of the facility's water-intensive landscaping shall be planted in those areas directly associated with the turf facility's primary purposes.*

2. *Beginning on January 1, 2002 or upon commencement of landscape watering, whichever occurs later, and continuing until the first compliance date for any substitute requirement in the Fourth Management Plan, an industrial user who uses water at a turf-related facility that is a cemetery shall limit the water-intensive landscaped area of post-1991 acres so that no more than 75 percent of the total cemetery area within the post-1991 acres is planted with plants not listed in Appendix 5B, Low Water Use/Drought Tolerant Plant List, or any modifications to the list, unless the post-1991 acres are an expansion of the cemetery onto contiguous land that was under the same ownership as the cemetery as of December 31, 1984.*

6-303. Calculation of Maximum Annual Water Allotment for Turf-Related Facilities

A. For each calendar year, the maximum annual water allotment for a turf-related facility shall be calculated by multiplying the number of acres in existence within the facility during the calendar year in each of the categories listed in Table 6-1 by the application rates listed in Table 6-1 and then adding together the products plus any allotment additions as determined under subsection B of this section. The maximum annual water allotment is subject to the conditions and restrictions set forth in Table 6-1.

TABLE 6-1
APPLICATION RATES, CONDITIONS, AND ALLOTMENT RESTRICTIONS FOR TURF-RELATED FACILITIES SANTA CRUZ ACTIVE MANAGEMENT AREA
From 2002 until the first compliance date for any substitute conservation requirement in the Fourth Management Plan

For All Facilities:	***Application Rate: (acre-feet per acre per calendar year)***
1. Pre-1985 Acres	
Turf Acres	*4.6*
Water Surface Acres	*5.8*
Low Water Use Landscaped Area	*1.5*
Conditions and Restrictions: *The allotment shall be calculated using the highest number of Pre-1985 acres in existence within the facility during any single calendar year after 1979.*	
2. First Management Period New Acres	
Turf Acres	*4.6*
Water Surface Acres	*5.8*
Low Water Use Landscaped Area	*1.5*
Conditions and Restrictions:	
a. For golf courses, the allotment for first management period new turf acres shall not exceed an amount calculated by multiplying the number of holes within those acres by 23 acre-feet of water, plus any allotment additions as determined under subsection B of this section.	
b. For golf courses, if the first management period new turf acres exceed an area calculated by multiplying the number of holes within those acres by five acres, the allotment for all bodies of water within the first management period new acres not filled and refilled entirely with direct use effluent or effluent recovered within the area of impact shall not exceed an amount calculated by multiplying the number of holes within the first management period new turf acres by 0.8056 acre-foot of water, plus any allotment additions as determined under subsection B of this section. For purposes of this paragraph, any body of water allowed under an interim water use permit pursuant to A.R.S. § 45-133 shall be deemed to be filled and refilled entirely with direct use effluent or effluent recovered within the area of impact if the body of water will be filled and refilled entirely with direct use effluent or effluent recovered within the area of impact after the permit expires.	
3. Post-1991 Acres	
Turf Acres	*4.6*
Total Water Surface Area	*5.8*
Low Water Use Landscaped Area	*1.5*

TABLE 6-1
APPLICATION RATES, CONDITIONS, AND ALLOTMENT RESTRICTIONS
FOR TURF-RELATED FACILITIES
SANTA CRUZ ACTIVE MANAGEMENT AREA
From 2002 until the first compliance date for any substitute conservation requirement in the Fourth Management Plan

For All Facilities:	***Application Rate: (acre-feet per acre per calendar year)***
Conditions and Restrictions: *a. For golf courses, the total allotment for post-1991 turf acres and post-1991 low water use landscaped area shall not exceed an amount calculated by multiplying the number of holes within the post-1991 acres by 23 acre-feet of water, plus any allotment additions as determined under subsection B of this section.* *b. For golf courses, the allotment for all bodies of water within the post-1991 acres not filled and refilled entirely with direct use effluent or effluent recovered within the area of impact shall not exceed an amount calculated by multiplying the number of holes within the post-1991 acres by 0.8056 acre-foot of water, plus any allotment additions as determined under subsection B of this section. For purposes of this paragraph, any body of water allowed under an interim water use permit pursuant to A.R.S. § 45-133 shall be deemed to be filled and refilled entirely with direct use effluent or effluent recovered within the area of impact if the body of water will be filled and refilled entirely with direct use effluent or effluent recovered within the area of impact after the permit expires.*	

B. Allotment Additions

1. Newly Turfed Area Establishment Addition

For any year in which a warm-season turfgrass species is planted at a turf-related facility, the facility shall receive an allotment addition of 1.0 acre-foot of water per acre of newly turfed area. For golf courses, the newly turfed area establishment addition shall not exceed an amount calculated by multiplying the number of holes present within the newly turfed area by 5 acre-feet of water.

2. Revegetation Addition

The owner or operator of a turf-related facility may apply to the director for an allotment addition to revegetate areas within or around the facility after initial construction or renovation of new acres. The director may allow up to an additional 1.5 acre-feet of water per acre for up to three years if the following conditions apply to the acres for which the revegetation addition is sought:

a. The plants which are planted within the revegetation area are listed in Appendix 5B, Low Water Use/Drought Tolerant Plant List, or any modifications to the list, or were adapted to the site prior to construction;

b. *The aggregate area to be watered exceeds one acre and has at least 50 percent vegetative cover at maturity;*

c. *An allotment is not provided for the revegetation area under section 6-303.A; and*

d. *All of the water applied to the revegetation area is measured and reported as part of the total water use of the facility.*

3. *Body of Water Fill and Refill Addition*

a. *A turf-related facility shall receive a one-time body of water fill allotment addition equal to the volume of water used for the initial filling of any new body of water added after January 1, 2002 within the facility. The facility shall receive the allotment addition only for the calendar year in which the body of water is filled.*

b. *If a body of water at a turf-related facility is drained or partially drained to allow for repairs to reduce water losses the owner or operator of the facility may apply to the director for an addition to the facility's maximum annual water allotment in the amount of water necessary to refill the body of water. The director shall grant the allotment addition if the director determines that drainage of the body of water was necessary to allow for repairs to reduce water losses. The facility shall receive the allotment addition only for the calendar year in which the body of water is filled.*

4. *Leaching Allotment Addition*

The owner or operator of a turf-related facility may apply to the director for an allotment addition for leaching purposes. The director shall approve the application if the water supply used for landscape watering at the facility contains at least 1000 milligrams per liter of total dissolved solids. If the director approves an allotment addition for leaching purposes, the director shall calculate the additional allotment as follows:

$$\textbf{\textit{Leaching Allotment Addition}} = \left(\frac{1}{1 - \left(\dfrac{EC_w}{5EC_e - EC_w} \right)} - 1 \right) \times \frac{CU}{0.85}$$

Where: EC_w = *Electrical conductivity of water used*

EC_e = *Tolerance of the grass species grown to the soil salinity in electrical conductivity of the soil saturation extract*

CU = *Consumptive use requirement for the grass species*

Any allotment addition granted under this subsection shall remain in effect until the water supply used for landscape watering at the facility contains less than 1,000 milligrams per liter of total dissolved solids or until the first compliance date for the facility's conservation requirements in the Fourth Management Plan, whichever occurs first.

C. ***Combined Allotments for Contiguous Facilities***

The maximum annual water allotments for contiguous turf-related facilities under one ownership or operation may be combined. All or a portion of the combined maximum water allotment may be applied to any part of the contiguous facilities.

D. *Nothing in this section shall be construed as authorizing use of more groundwater or surface water than may be used pursuant to any groundwater or appropriable water rights or permits associated with the use. Nor shall this section be construed as authorizing the use groundwater or surface water in any manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.*

6-304. Compliance with Maximum Annual Water Allotment

A. Effluent Use Adjustment

For purposes of determining compliance with the maximum annual water allotment requirement, the director shall count each acre-foot of direct use effluent or effluent recovered within the area of impact used at the facility for landscape watering purposes during the calendar year as 0.7 acre-foot of water.

B. Flexibility Account

The director shall determine if a turf-related facility is in compliance with the maximum annual water allotment requirement through the maintenance of a flexibility account for the facility according to the following:

1. *Beginning with calendar year 2002 or the first full calendar year after the commencement of landscape watering, whichever is later, a flexibility account shall be established for a turf-related facility with a beginning balance of zero acre-feet.*

2. *Following each calendar year in which water is withdrawn, diverted, or received for landscape watering purposes at the facility, the director shall adjust the turf-related facility's flexibility account as follows:*

   a. *Subtract the total volume of water from any source, including effluent, as adjusted under subsection A above, used by the facility for landscape watering purposes during that calendar year, from the facility's maximum annual water allotment for that year.*

   b. *If the result in subparagraph a of this paragraph is positive, credit the flexibility account by this volume.*

   c. *If the result in subparagraph a of this paragraph is negative, debit the flexibility account by this volume.*

3. *The account balance existing in a turf-related facility's flexibility account after the adjustment provided for in paragraph 2 is made shall carry forward subject to the following limitations:*

   a. *The maximum positive account balance allowed in the flexibility account of a turf-related facility after any credits are registered pursuant to paragraph 2,* *subparagraph b of this subsection, shall be calculated by multiplying the facility's maximum annual water allotment for the year for which the credits are registered by 0.2. If the account balance exceeds the maximum positive account balance after the credits are registered, the balance carried forward shall be equal to the maximum positive account balance.*

b. *The maximum negative account balance allowed in the flexibility account of a turf-related facility after any debits are registered pursuant to paragraph 2, subparagraph c of this subsection, shall be calculated by multiplying the facility's maximum annual water allotment for the year for which the debits are registered by -0.2. If the account balance is less than the maximum negative account balance after the debits are registered, the balance carried forward shall be equal to the maximum negative account balance.*

C. Compliance Status

If the adjustment to a turf-related facility's flexibility account following a calendar year as provided for in subsection B, paragraph 2, causes the account to have a negative account balance less than the maximum negative account balance allowed in the flexibility account for the calendar year as calculated in paragraph 3, subparagraph b, the industrial user who uses water at the facility is in violation of the facility's maximum annual water allotment for that year in an amount equal to the difference between the facility's flexibility account balance and the maximum negative balance allowed in the facility's flexibility account.

6-305. Monitoring and Reporting Requirements

A. *An industrial user who uses water at a turf-related facility that commences landscape watering within post-1991 acres after January 1, 2002 shall submit to the director documentation of the new acreage within the facility no later than 90 days after commencing landscape watering within the new acres or receiving notice of these conservation requirements, whichever is later. The scale of the submitted documents, extent of turf acres, water surface acres, and low water use landscaped area must clearly be shown. Documentation may consist of one or more of the following:*

1. *As-built plans certified by a registered professional such a civil engineer, golf course designer, or landscape architect.*

2. *Aerial photography at a scale no smaller than 1"=200'.*

3. *A survey of the facility certified by a registered professional such a civil engineer or land surveyor.*

4. *Any other documentation upon approval by the director.*

B. *For calendar year 2002 or the calendar year in which landscape watering commences, whichever occurs later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the Fourth Management Plan, an industrial user who uses water at a turf-related facility shall include in the annual report required by A.R.S. 45-632 the following information:*

1. *The total quantity of water by source, disaggregated by each source, withdrawn, diverted, or received during the calendar year for landscape watering purposes at the facility, as*

measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

2. *The amount of effluent, disaggregated by direct use effluent, effluent recovered within the area of impact, and effluent recovered outside the area of impact, that was withdrawn, diverted, or received during the calendar year for landscape watering purposes as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

3. *The number of acres of turf acres within the facility during the calendar year, not including newly turfed area.*

4. *The number of water surface acres within the facility during the calendar year.*

5. *The number of acres of low water use landscaped area within the facility during the calendar year.*

6. *The number of acres of newly turfed area within the facility during the calendar year.*

7. *The number of turf acres removed within the facility during the calendar year.*

8. *The number of water surface acres added or removed within the facility during the calendar year.*

9. *The number of acres of low water use landscaped area added or removed within the facility during the calendar year.*

10. *If the facility is a golf course, the length of the course as measured from the back of each tee ground furthest from the associated green, then down the center line of the hole to the center of the green.*

11. *The number of acres approved by the director for a revegetation addition pursuant to section 6-303, subsection B, within the facility during the calendar year.*

12. *The quantity of water used to fill or refill a body of water within the facility during the calendar year for which an allotment addition is sought pursuant to section 6-303, subsection B.*

13. *The number of acres of overseeded area within the facility during the calendar year.*

14. *If the facility is a golf course, the number of holes within the facility during the calendar year.*

15. *If the facility is a golf course, the number of holes added within newly turfed area during the calendar year.*

16. *An estimate of the quantity of water from any source, including effluent, used for each purpose other than landscape watering purposes at the facility during the reporting year. Any water used at the facility that is not measured separately from the water used for landscape watering shall be counted by the director as water used by the facility for landscape watering for purposes of calculating the compliance with the maximum annual water allotment.*

C. *A single annual report may be filed for contiguous turf-related facilities which are under the same ownership or operation if the allotments for the contiguous facilities are combined pursuant to section 6-303, subsection C. The annual report shall report water use and landscaped areas of the contiguous facilities as required in subsection B of this section.*

6.4 SAND AND GRAVEL FACILITIES

6.4.1 Introduction

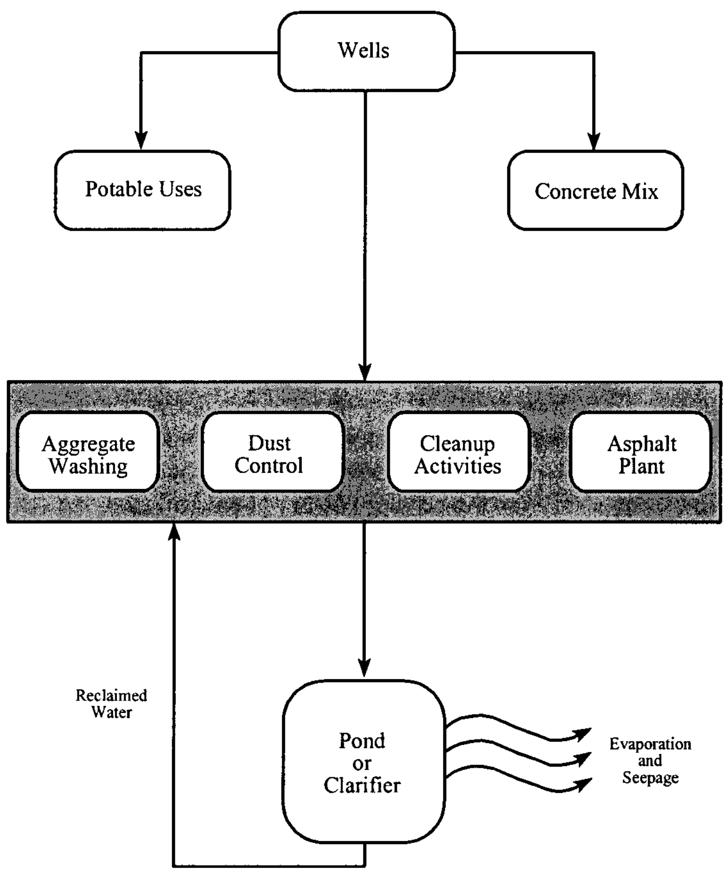
Sand and gravel facilities regulated under the Third Management Plan are facilities that produce sand and gravel and use more than 100 acre-feet of water from any source in a calendar year. Sand and gravel facilities include the activities of mining aggregate, mixing concrete, and producing asphaltic concrete.

6.4.2 Water Use by Sand and Gravel Facilities

There is one sand and gravel facility in the Santa Cruz AMA that is large enough to be regulated. This facility withdraws water pursuant to a groundwater withdrawal permit. It is projected that water use by this facility will grow commensurate with economic activity in the AMA.

Sand and gravel facilities mine unconsolidated stream deposits to produce construction materials. The aggregate must be sorted according to grain size and washed to remove fine-grained particles. Aggregate washing accounts for the bulk of water use by sand and gravel facilities. In addition to using water for washing, water is used for the following purposes: (1) to produce ready-mix concrete, bricks, blocks, and asphaltic concrete; (2) to control dust; (3) to wash the outside of vehicles; (4) to wash the inside of mixer drums; (5) to wash other equipment; (6) to cool equipment; (7) to cool material; and (8) for domestic purposes. Figure 6-1 illustrates how water is cycled in a typical sand and gravel facility.

FIGURE 6-1
DIAGRAM OF WATER FLOW IN A TYPICAL SAND AND GRAVEL FACILITY



Most sand and gravel facilities recycle wash water using excavated pits called disposal ponds. Sediment-laden wash water is pumped or diverted into a pit or series of pits where sediment is allowed to settle out. After this sediment settles out, the water is recycled to the plant and used to wash more material. Water can also be pumped from the pond for dust control, truck washing, or other cleanup activities.

Geologic and hydrologic conditions at many facilities may result in a large amount of seepage loss incidentally returning to the aquifer from disposal ponds. Because most facilities are located along major riverbeds, depth to water is usually relatively shallow. Some facilities even require dewatering to lower the water table to allow excavation to occur. A large portion of seepage loss may become a component of the water pumped by sand and gravel facilities.

An alternative method of recycling wash water is the use of clarifiers. A clarifier is a device which accelerates the settling of sediment without creating the need for a large disposal pond. Chemical flocculants are usually used in conjunction with clarifiers to further enhance the removal of solid particles from the wash water.

Recycled water is not used for mixing concrete because the use of recycled water in the mixture may result in a product of inferior strength and quality. However, aggregate used in the concrete can be washed with recycled water without affecting concrete strength.

The ability of sand and gravel facilities to save water varies because of differences in geology, availability and cost of land and water, product demand and price, and other factors. It may therefore be economically feasible to use the latest commercially available conservation technology at some facilities but not at others.

Because recycled water can be used for most purposes at a sand and gravel facility, the maximum saving of water can occur in the recycling of wash water from aggregate washing and, to a lesser extent, the recycling of water used for wet scrubbers at asphalt plants.

There are a number of conservation techniques that may be employed to reduce the amount of water used to control dust raised by trucks traveling on haul roads. Binding agents, pavement, or other surface treatments may be used. Water uses for cleanup activities may be made more efficient by metering truck washing and by using alternative methods to clean truck mixer drums. Alternative methods can include the "rock out" method, which involves agitating rock inside the mixer drums for the purpose of cleaning excess concrete, or the use of chemical set-arresting agents, which prevent excess concrete from adhering to the mixer drums.

Sand and gravel facilities that have asphalt plants may have air emissions from the plant cleaned by either baghouses or wet scrubbers. Of these two methods, baghouses do not require water.

6.4.3 Program Development and Issues

The First Management Plan required sand and gravel facilities to recycle wash water using disposal ponds or clarifiers. This requirement ensures that sand and gravel facilities reduce their water use. The First Management Plan requirements were carried over into the second management period.

To identify the most economical conservation methods for each facility, sand and gravel facility operators were required during the second management period to evaluate specific water-saving methods and submit a conservation plan to the Department.

In addition to the conservation requirements identified in the First and Second Management Plans, there are a number of economically feasible ways water use for dust control and cleanup activities can be reduced. However, because conditions and characteristics at each facility vary, flexibility is needed to allow facility operators to select the requirements most appropriate for their facility.

6.4.4 Sand and Gravel Conservation Program

The First and Second Management Plan requirements for recycling wash water are included for the third management period because implementation of recycling improves water use efficiency. All sand and gravel operations can apply these techniques.

In addition to recycling wash water, sand and gravel facility operators must implement two additional conservation measures, one related to water used for dust control and the other related to cleanup activities. The facility operator must choose the conservation measure to be implemented in each category from a list of approved measures. The measures chosen must be the most appropriate for the facility for the third management period.

Similar to the Second Management Plan, sand and gravel operators will be required to evaluate specific water-saving methods and submit a conservation plan to the Department during the third management period. The conservation plan must be submitted to the director by January 1, 2002 or within 180 days after notification of the conservation requirements, whichever is later.

Implementation of water conservation practices or technologies can result in increased profits. Sand and gravel facility operators should analyze conservation methods to identify those that will result in a positive economic return. Operators will be required to perform an economic feasibility analysis of three potential conservation practices: disposal pond surface area reduction, use of clarifiers, and the use of an alternative water supply to groundwater. The following potential costs and savings may be analyzed in the economic feasibility analysis:

- Labor (including planning, construction, operation, maintenance, and management time);
- Equipment (values amortized over the projected life of the equipment);
- Land value (including value of mineral reserves);
- Water costs (including pumping costs, well maintenance, and withdrawal taxes);
- Costs for chemicals and raw materials;
- Fuel or energy costs;
- Industrial wastewater disposal costs;
- Changes in revenue caused by changing production rate, minimizing "down-time," or increasing the size of reserves; and
- Regulatory permitting costs.

6.4.5 Future Directions

Sand and gravel operations in the Santa Cruz AMA have essentially been limited to one facility. However, there are additional rights and permits within the AMA that could be used in the future for sand and gravel operations. Although the permits may expire before they are put to full use, the rights may become active during the third management period if industry economic conditions make extraction at these sites more viable.

Providing additional assistance and education for increased water management efficiency in the Sand and Gravel sector could facilitate the achievement of the Santa Cruz AMA goal.

6.4.6 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Sand and Gravel Facilities

6-401. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-201 of this chapter, the following words and phrases used in sections 6-402 through 6-404 of this chapter, unless the context otherwise requires, shall have the following meanings:

1. *"Alternative water supply" means a water source other than water of drinking water quality.*

2. *"Sand and gravel facility" means a facility that produces sand and gravel and that uses more than 100 acre-feet of water from any source per calendar year. For purposes of this definition, the annual water use shall include all water used by the facility regardless of the nature of the use.*

3. *"Rock out method" means agitating rock inside concrete truck mixer drums for the purpose of cleaning excess concrete from the drums.*

4. *"Wash water" means water used for washing or sorting sand, gravel, or other aggregates.*

6-402. Conservation Requirements

A. Standard Conservation Requirements

Beginning on January 1, 2002 or upon commencement of water use, whichever occurs later, and continuing thereafter until the first compliance date for any substitute conservation requirements in the Fourth Management Plan, an industrial user who uses water at a sand and gravel facility shall comply with the following conservation requirements:

1. *If sufficient land area for construction and operation of disposal ponds is available at a reasonable price, the industrial user shall construct disposal ponds at the sand and gravel facility. All wash water, all water used for wet scrubbers at asphalt plants, all runoff from cleanup operations and all drainage from sand and gravel piles shall be discharged or diverted into the disposal ponds unless prohibited by state or federal environmental regulations. The disposal ponds shall contain a barge pump or sump pump of sufficient capacity, together with any necessary additional equipment, to assure the maximum reclamation of the water. The water shall be reclaimed and reused at the sand and gravel facility unless prohibited by state or federal regulations.*

2. *If sufficient land area for the construction and operation of disposal ponds is not available at a reasonable price, clarifiers shall be used at the sand and gravel facility for reclaiming wash water, all water used for wet scrubbers at asphalt plants, runoff from cleanup operations and all drainage from sand and gravel piles. The clarifiers shall be designed and operated to assure the maximum reclamation of water. The water shall be reclaimed and reused at the sand and gravel facility unless prohibited by state or federal regulations.*

3. *At least one of the following techniques or technologies designed to reduce water use for dust control shall be implemented at the sand and gravel facility:*

   a. *The placement of binding agents on all haul roads;*

   b. *The paving of all haul roads;*

   c. *The placement of recycled asphalt on all haul roads;*

   d. *The placement of medium sized aggregate or "pea gravel" on all haul roads; or*

   e. *A technology or technique designed to reduce water use for dust control not included in subparagraphs a through d of this paragraph, which demonstrates water savings equivalent to any of the technologies or techniques listed in subparagraphs a through d, and which has been approved by the director.*

   The industrial user shall have sole discretion in determining whether to implement more than one of the above technologies.

4. *At least one of the following techniques or technologies designed to reduce water use for cleaning shall be implemented at the sand and gravel facility:*

   a. *Use of metered timers for truck washing and other cleanup activities;*

   b. *Use of the "rock out method" of cleaning concrete from truck mixer drums;*

   c. *Use of concrete set-arresting agent chemical applications to clean concrete from truck mixer drums;*

   d. *A technology or technique designed to reduce water use for cleaning that is not included in subparagraphs a through c of this paragraph, which demonstrates water savings equivalent to any of the measures listed in subparagraphs a through c, and which has been approved by the director.*

   The industrial user shall have sole discretion in determining whether to implement more than one of the above technologies.

B. Substitute Conservation Requirements

1. *An industrial user who uses water at a sand and gravel facility may apply to the director to use conservation technologies other than the standard conservation requirements prescribed in subsection A of this section. The director may approve the use of substitute conservation technologies if both of the following apply:*

   a. *The industrial user has submitted a detailed description of the proposed substitute technologies and the water savings that can be achieved by the use of those technologies, and;*

   b. *The director determines that the proposed substitute conservation technologies will result in a water savings equal to or greater than the savings that would be achieved by the standard conservation requirements prescribed in section 6-402.*

2. *If the director approves an industrial user's request to use conservation technologies other than the standard conservation requirements prescribed in subsection A of this section, the industrial user shall comply with the substitute conservation technologies approved by the director beginning on the date determined by the director and continuing until the first compliance date for any substitute conservation requirement in the Fourth Management Plan.*

C. Conservation Plan

Not later than January 1, 2002 or within 180 days after receiving notice of these conservation requirements, whichever is later, an industrial user who uses water at a sand and gravel facility, including an industrial user who acquires ownership of an existing sand and gravel facility after January 1, 2002, shall submit to the director a plan to improve the efficiency of water use at the facility on a form provided by the director. The plan shall analyze the economic feasibility of implementing all of the following at the facility:

1. *Disposal pond surface area reduction;*

2. *The use of clarifiers for recycling water;*

3. *Use of an alternative water supply if such a supply is available within a one mile radius of the facility.*

6-403. Monitoring and Reporting Requirements

For calendar year 2002 or the calendar year in which the sand and gravel facility first commences using water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the Fourth Management Plan, an industrial user who uses water at a sand and gravel facility shall include the following information in its annual report required by A.R.S. § 45-632:

1. *The quantity of water reclaimed from disposal ponds or clarifiers during the calendar year, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

2. *The quantity of water from any source, including effluent, supplied to the wash plant during the calendar year, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

3. *The quantity of water from any source, including effluent, supplied to the asphalt plant during the calendar year, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

4. *The aggregate surface area of any disposal ponds.*

5. *The average depth of any disposal ponds.*

6. *The estimated quantity of water from any source, including effluent, used during the calendar year for:*

a. *Industrial process purposes. Water used for industrial process purposes includes water used for sanitary waste disposal but does not include water used for cooling and cleaning purposes.*

b. *Non-domestic cooling purposes.*

c. *Non-domestic cleaning purposes. Water use for non-domestic purposes includes truck washing, truck mixer drum washing, or other non-domestic cleaning purposes.*

d. *Road dust control.*

e. *Landscape watering.*

f. *Other purposes.*

7. *The tonnage of material washed during the calendar year.*

6.5 NEW LARGE LANDSCAPE USERS

6.5.1 Introduction

New large landscape users are industrial users with a substantial water-intensive landscaped area that was planted after January 1, 1990. The conservation program differentiates between two types of new large landscape users: non-residential facilities that are hotels or motels and non-residential facilities that are not hotels or motels. If the facility is not a hotel or motel, conservation requirements apply to landscapable areas in excess of 10,000 square feet. If the facility is a hotel or motel, requirements apply to landscapable areas in excess of 20,000 square feet. If a facility has 10 or more acres of water-intensive landscaped area it is defined as a turf-related facility and is subject to specific conservation requirements discussed in section 6.3 of this chapter.

6.5.2 Water Use by New Large Landscape Users

Water use associated with landscaping is directly related to the size of the landscaped area, the types of vegetation, and the efficiency of the irrigation method used. Although low water use residential landscaping is common in the Santa Cruz AMA, significant water use may be associated with the landscaping of industrial parks, large commercial and institutional facilities. A nine-acre hotel landscape could use more than 40 acre-feet per year if it was planted entirely with water-intensive plants. This is enough water to supply about 104 households per year. By restricting lush plantings and water features to those areas that may be used for recreation or near areas that receive the most visitation, considerable water savings may be realized. Under the Third Management Plan requirements, this same facility would use about 10 acre-feet per year to meet its landscaping needs while still maintaining an esthetically pleasing and lush landscape.

No new large landscape users were identified during the second management period. While there are some large resorts and commercial facilities within water provider service areas, the potential exists for new facilities to be served by their own wells. It is difficult to predict the extent of growth possible in this subsector, but the potential for future facility construction and for corresponding significant water use exists.

6.5.3 Program Development and Issues

Consultant studies done for the Second Management Plan indicated that significant reductions in landscape water use can be achieved using the following techniques:

- Improving water application efficiency through proper irrigation scheduling, use of more sophisticated control systems, conversion to drip irrigation, and grouping plants with similar water needs.
- Reducing the size and perimeter of turfed areas and limiting the placement of turfed areas to functional use areas and areas of high visual impact.
- Using drought-resistant plant species adapted to the desert.
- Using proper planting, fertilization, and maintenance techniques.
- Grading sites to direct rainfall into planted areas.
- Avoiding the use of water-intensive plants within rights-of-way thus emphasizing the community's commitment to low water use designs.

The findings from these studies still apply for the third management period. Attractive landscapes can be maintained solely with rainfall. However, a lush, colorful, low water use landscape watered by a permanent drip irrigation system is considered more desirable for commercial and industrial landscape applications. This type of landscape results in water savings of 50 to 75 percent of the amount used by a well-maintained turf (water-intensive) landscape.

The distinction in the program between hotel or motel landscapes and landscapes that are associated with facilities that are not hotels or motels is intended to address the contention by the lodging industry that for certain hotel and motel developments there is an economic benefit from planting high water using landscape plant material, thus economically justifying a larger water-intensive area.

6.5.4 New Large Landscape User Program

The new large landscape user program for the Third Management Plan is similar to that in the Second Management Plan. In addition to the requirements that apply to all industrial users, new large landscape users must limit the percentage of water-intensive landscaped area above a specified square footage. The facility must limit its water-intensive landscaped area to the greater of the following: (1) 10,000 square feet (20,000 square feet for hotels and motels) plus 20 percent of the area in excess of 10,000 square feet (20,000 square feet for hotels and motels) and (2) the total surface area of all bodies of water within the facility that qualify as water intensive landscaped area.

Water-intensive landscaping includes not only high water using plants such as turf, but also bodies of water such as ponds. However, it does not include any area of land watered exclusively with direct use effluent, bodies of water used primarily for swimming, bodies of water filled and refilled exclusively with direct use effluent and bodies of water allowed under an interim water use permit pursuant to the Lakes Bill if the body of water will be filled and refilled exclusively with direct use effluent after the permit expires. Direct use effluent is effluent that is either used directly or is stored underground and then recovered within the area of impact. If 100 percent wastewater is used to water the landscape, the requirements do not apply. For example, if there is sufficient cooling tower blowdown water and greywater available from the operations of a hotel, this wastewater could be used to water any amount of water-intensive landscaped area up to 10 acres. Once a water-intensive landscaped area equals or exceeds 10 acres in size, it is defined as a turf-related facility and is subject to regulation under that program.

6.5.5 Industrial Conservation Requirements and Monitoring and Reporting Requirements for New Large Landscape Users

6-501. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-201 of this chapter, unless the context otherwise requires, the following words and phrases used in sections 6-502 through 6-503 of this chapter shall have the following meanings:

1. *"Direct use effluent" means effluent transported directly from a facility regulated pursuant to Title 49, Chapter 2, Arizona Revised Statutes, to an end user. Direct use effluent does not include effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes.*

2. *"Effluent recovered within the area of impact" means effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes, and recovered within the stored effluent's area of impact. For purposes of this definition, "area of impact" has the same meaning as prescribed by A.R.S. § 45-802.01.*

3. *"Landscapable area" means the entire area of a lot less any areas covered by structures, parking lots, roads, or any other area not physically capable of being landscaped.*

4. *"New large landscape user" means a non-residential facility that has a water-intensive landscaped area in excess of 10,000 square feet and that has landscaping planted and maintained after January 1, 1990 or bodies of water, other than bodies of water used primarily for swimming purposes, filled and maintained after January 1, 1990, or both. Turf-related facilities as defined in section 6-301 of this chapter are excluded from this definition.*

5. *"Water-intensive landscaped area" means, for the calendar year in question, all of the following areas within a non-residential facility:*

   a. *Any area of land that is planted primarily with plants not listed in Appendix 5B, Low Water Use/Drought Tolerant Plant list, or any modifications to the list, and watered with a permanent water application system, except any area of land that is watered exclusively with direct use effluent*

   b. *The total water surface area of all bodies of water area within the facility, except bodies of water used primarily for swimming purposes, bodies of water filled and refilled exclusively with direct use effluent or effluent recovered within the area of impact, and bodies of water allowed under an interim water use permit pursuant to A.R.S. § 45-133 if the bodies of water will be filled and refilled exclusively with direct use effluent after the permit expires.*

6-502. Conservation Requirements

A. Conservation Requirements for New Large Landscape Users that are not Hotels or Motels
Beginning on January 1, 2002 and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, the water-intensive landscaped area within a new large landscape user that is not a hotel or motel shall not exceed the greater of the following: (1) an area calculated by adding 10,000 square feet plus

20 percent of the facility's landscapable area in excess of 10,000 square feet; and (2) the total water surface area of all bodies of water within the facility that are allowed under A.R.S. § 45-131, et seq., and that qualify as water-intensive landscaped area.

B. Conservation Requirements for New Large Landscape Users that are Hotels or Motels

Beginning on January 1, 2002 and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, the water-intensive landscaped area within a new large landscape user that is a hotel or motel shall not exceed the greater of the following: (1) an area calculated by adding 20,000 square feet plus 20 percent of the facility's landscapable area in excess of 20,000 square feet; and (2) the total water surface area of all bodies of water within the facility that are allowed under A.R.S. § 45-131, et seq, and that qualify as water-intensive landscaped area.

C. Waiver of Conservation Requirements for the Use of 100 Percent Wastewater

The conservation requirements set forth in subsections A and B of this section shall not apply to a new large landscape user in any year in which all of the water used for landscaping purposes within the facility is wastewater.

6-503. Monitoring and Reporting Requirements

For calendar year 2002 or the calendar year in which the facility first begins to use water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the Fourth Management Plan, an industrial user that applies water to a new large landscape user shall include the following information in its annual report required by A.R.S. § 45-632:

1. *The total quantity of water from any source, including effluent, withdrawn, diverted, or received for use on the facility during the calendar year for landscape watering purposes, including bodies of water filled or refilled during the calendar year, as measured with a measuring device in accordance with the Department's measuring device rules. A.A.C. R12-15-901, et seq.*

2. *The total amount of landscapable area within the facility.*

3. *The total amount of water-intensive landscaped area at the facility broken down into the area planted primarily with plants not on the low water use plant list (except any area watered exclusively with direct use effluent or effluent recovered within the area of impact) and the surface area of all bodies of water (except bodies of water used primarily for swimming purposes, bodies of water filled and refilled exclusively with direct use effluent or effluent recovered within the area of impact, and bodies of water allowed under an interim water use permit if the bodies of water will be filled and refilled exclusively with direct use effluent after the permit expires).*

6.6 NEW LARGE INDUSTRIAL USERS

6.6.1 Introduction

New large industrial users are industrial users that use in excess of 100 acre-feet of water per year and commence use after January 1, 2000. In the Second Management Plan, new large industrial users were defined as industrial users that use in excess of 100 acre-feet per year and commenced use after January 1, 1990. As of February, 1998, all of the new large industrial users identified in the Santa Cruz AMA were industrial users subject to specific conservation requirements discussed elsewhere in this chapter (e.g., metal mines, turf-related facilities, etc.).

6.6.2 Water Use by New Large Industrial Users

As of December, 1998, there are currently no industrial facilities in the Santa Cruz AMA, other than turf-related and sand and gravel facilities, which individually use more than 100 acre-feet of water during the year. There are 13 rights and permits with allotments of over 100 acre-feet per year. These rights are either being used to withdraw less than 100 acre-feet per year or are not being used at all. The allotments for these 13 rights and permits total over 6,400 acre-feet. Although some of this large volume could potentially be used to serve new large industrial users, growth potential is difficult to predict. New large commercial or manufacturing facilities are often constructed within water company service areas and are customers of the water provider. Commercial water use in the Santa Cruz AMA includes a significant portion of use related to the packing, shipping and processing of produce. In the future, new large produce processing facilities may be added to the AMA and may individually use more than 100 acre-feet of water. A new produce processing facility that uses more than 100 acre-feet of water annually would be regulated as a new large industrial user in the Third Management Plan. The Santa Cruz AMA will continue to examine water use related to industry in this area and may include in a management plan modification further conservation requirements.

6.6.3 Program Development and Issues

There were no requirements for new industrial users in the First Management Plan. In addition to the conservation requirements for all industrial users, the Second Management Plan contains a specific conservation requirement for new industrial users that use over 100 acre-feet of water per year. In the Second Management Plan, new industrial users were required to prepare and submit a water conservation plan addressing the water conservation opportunities at the facility. The user was required to develop a plan which:

- describes the level of water conservation that can be achieved,
- identifies the water uses and conservation opportunities within the facility,
- describes an ongoing water conservation education program for employees, and
- includes an implementation schedule.

The Department has determined that submitting a conservation plan is a reasonable requirement to continue for the Third Management Plan considering the large volume of unused allotments that could be used for new large industrial uses and the corresponding opportunity to design water conservation into new or expanding facilities. When facilities expand, even after operation has commenced, there are additional water conservation opportunities associated with being able to "build in" water conserving designs. This is typically more economical and more feasible than retrofitting a facility that is not expanding.

6.6.4 <u>New Large Industrial User Conservation Program</u>

The new large industrial user program for the Third Management Plan is identical to that of the Second Management Plan. In addition to the requirements that apply to All Industrial Users, new large industrial users must prepare and submit a water conservation plan to the director. However, if the user is required to submit a conservation plan under another section of this chapter, it can combine the plans and submit one plan.

The water conservation plan must show how much water conservation can be achieved at the facility. It must identify how water is used at the facility and what can be done to conserve in major water use areas. The plan must also detail an employee water conservation education program at the facility and describe when conservation measures will be implemented.

6.6.5 Industrial Conservation Requirements and Monitoring and Reporting Requirements for New Large Industrial Users

6-601. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-201 of this chapter, "new large industrial user" means an industrial user that begins using more than 100 acre-feet of water per year for industrial purposes after January 1, 2000.

6-602. Conservation Requirements

A. *Not later than January 1, 2002 or within 180 days after the end of the first calendar year in which the facility first uses more than 100 acre-feet of water for industrial purposes, whichever is later, a new large industrial user shall submit to the director a plan to improve the efficiency of water use by the facility. The plan shall:*

1. *Specify the level of water conservation that can be achieved assuming the use of the latest commercially available technology consistent with reasonable economic return;*

2. *Identify water uses and conservation opportunities within the facility, addressing water used for the following categories as appropriate: landscaping; space cooling; process-related water use, including recycling; and sanitary and kitchen uses;*

3. *Describe an ongoing water conservation education program for employees; and*

4. *Include an implementation schedule.*

B. *If a person required to submit a plan under subsection A of this section is required to submit a conservation plan under another section of this chapter, the person may combine the plans into a single conservation plan.*

REFERENCES

Brown, P., Gilbert, J., and D. Kopec, 1996. *Final Report to the Arizona Department of Water Resources, Turfgrass Irrigation Scheduling Using Weather Based Estimates of Evapotranspiration for High and Low Traffic Turfs.* Contract No. CA94TU103-00, May 31, 1996.

APPENDIX 6
TURF-RELATED FACILITIES
SANTA CRUZ ACTIVE MANAGEMENT AREA

Facility Name	Water Source	Water Supply	Right Number
GOLF COURSES			
Kino Springs GC	City of Nogales	Water Withdrawn from Wells	56-000002
Palo Duro GC	City of Nogales	Water Withdrawn from Wells	56-000002
Rio Rico GC	Type II	Water Withdrawn from Wells	58-112482
Tubac Ranch Resort GC	Type II	Water Withdrawn from Wells	58-111271

CHAPTER

7

Groundwater Quality Management Program

7.1 INTRODUCTION

Water quality is an important component in the management of the water supply in the Santa Cruz Active Management Area (AMA). The role of the Arizona Department of Water Resources (Department) in water quality relates to the impacts of water quality on available water supplies. Protecting and managing water quality maximizes the overall quantity of usable water, and matching the best use to the quality of water is a significant aspect of meeting the Department's water management objectives. This chapter defines the Department's role and authority in groundwater quality management during the third management period and addresses water quality impacts on the management of water supplies in the Santa Cruz AMA.

The Department's water quality responsibilities include enhancement of groundwater quality protection programs, assistance in the cleanup of contaminated areas, and assistance in matching water quality with the highest beneficial use. In the third management period, the Department will play a greater role in water quality issues because of increased responsibilities and funding for water quality management activities provided for in the 1997 Water Quality Assurance Revolving Fund (WQARF) Program reform legislation. Laws 1997, Ch. 287. Furthermore, the utilization of effluent as well as the designation of end uses for remediated groundwater will play a larger role in water supply decisions during the third management period.

In general, groundwater in the Santa Cruz AMA is of acceptable quality for most uses. Most of the groundwater resources meet federal and state drinking water standards, though contaminant levels exceed primary safe drinking water standards in a few areas. Water withdrawn from wells within these identified areas has been discontinued or the contaminated water is in the process of being cleaned up. Other areas of known contamination which are not being remediated are monitored to ensure that contaminants do not spread.

In this chapter, the following topics are discussed in the order listed:

- Goals and Objectives
- Statutory Provisions
- Regulation of Groundwater Quality in Arizona
- Water Quality Assessment
- Third Management Plan Program Summary
- Future Directions

7.2 GOALS AND OBJECTIVES

The Department recognizes that the goal of remediating contaminated groundwater is important and intends to facilitate such remediation by implementing incentives for remediated groundwater use. However, the Department has the responsibility in the Santa Cruz AMA of maintaining safe-yield conditions and preventing long-term declines in local water table levels. In order to protect and ensure effective water management remediation incentives should be consistent with the AMA water management goals. Coordinated efforts between the Arizona Department of Environmental Quality (ADEQ) and the Department will help to ensure that water management and water quality objectives are both met.

To achieve its groundwater quality management objectives, the Department will "coordinate and confer" with ADEQ regarding "water plans, water resource planning, water management, wells, water rights and permits, and other appropriate provisions of [Title 45] pertaining to remedial investigations, feasibility studies, site prioritization, selection of remedies and implementation of the [WQARF] program pursuant to title 49, chapter 2, article 5." A.R.S. § 45-105(B)(4)(c). A Memorandum of Understanding between the Department and ADEQ will be developed to address this cooperative effort.

The Department's goals and objectives for groundwater quality management for the third management period are as follows:

- to ensure that remediation of contaminated groundwater uses the least amount of groundwater necessary to facilitate the objectives of each remedial action project.

- to ensure that end uses of remediated groundwater minimize water withdrawn from wells and is consistent with the maintenance of safe-yield conditions and the prevention of long-term declines in local water table levels.

- to ensure that water quality considerations affecting Department programs that extend beyond the scope of the WQARF Program are also addressed in order to preserve groundwater quality and quantity. Some of these considerations include well construction and abandonment standards, well spacing, assured water supply, recharge, and groundwater withdrawal permits.

Pursuant to the WQARF Program, the Department will respond first to the highest ranked sites on the WQARF site registry. The Department's objectives are to ensure that remedial action projects are not an impediment to achieving the management goals for each AMA, and that cleanups are performed in a prudent and efficient manner from a water management perspective.

7.3 STATUTORY PROVISIONS

ADEQ is the agency primarily responsible for regulating water quality. The Department also has some limited responsibilities in this area. Statutory provisions pertaining to the Department's limited authority to regulate groundwater quality are discussed below.

The Code grants the Department authority to regulate groundwater. Under the Code, the Department has the following authority and responsibilities relating to water quality:

- "[T]he director may ... [f]ormulate plans and develop programs for the practical and economical development, management, conservation and use of surface water, groundwater and the watersheds in this state, including the management of water quantity and quality." A.R.S. § 45-105(A)(1).

- "[T]he director may ... [c]onduct feasibility studies and remedial investigations relating to groundwater quality and enter into contracts and cooperative agreements under § 104 of the comprehensive environmental response, compensation, and liability act of 1980 (P.L. 96-510) to conduct such studies and investigations." A.R.S. § 45-105(A)(16).

- For the third management period, the director "shall, in cooperation with the department of environmental quality, include in each [management] plan an assessment of groundwater quality in the active management area and any proposed program for groundwater quality protection. Any such program shall be submitted to the legislature for any necessary enabling legislation or coordination with existing programs of the department of environmental quality." A.R.S. § 45-566(A)(7).

- "[T]he director shall consult with the department of environmental quality on water quality considerations in developing and implementing management plans under this article." A.R.S.§ 45-573.

The WQARF legislation, as revised in 1997, expands the Department's role in water quality management. The Department's responsibilities and authority under WQARF, which will be explained in greater detail later in this chapter, include the following:

- "[T]he director of water resources, in consultation with the director of environmental quality, may inspect wells for vertical cross-contamination of groundwater by hazardous substances and may take appropriate remedial actions to prevent or mitigate the cross-contamination ...." A.R.S. § 45-605(A).

- "[T]he director [of water resources] shall notify an applicant for a permit or a person who files a notice of intent to drill a new or replacement well if the location of the proposed well is within a subbasin where there is a site [with existing or future groundwater contamination presenting a risk of vertical cross-contamination by the well]." The director is also required to adopt rules relating to vertical cross-contamination and new or replacement wells. A.R.S. § 45-605(E).

- "[T]he director of environmental quality and the director of water resources shall coordinate their efforts to expedite remedial actions, including obtaining information pertinent to site investigations, remedial investigations, site management and beneficial use of remediated water." A.R.S. § 49-290.01(C).

- The director of water resources may waive permits, approvals or authorizations if they "unreasonably limit the completion of a remedial action." A.R.S. § 49-290.01(A). The director of water resources may also waive any regulatory requirement under Title 45 if the requirement conflicts with the selected remedy in a remedial action as long as the waiver does not "result in adverse impacts to other land and water users." A.R.S. § 49-290.01(D).

- "The department of water resources shall include in its management plans ... provisions to encourage the beneficial use of groundwater that is withdrawn pursuant to approved remedial action projects ...." Laws 1997, Ch. 287, Sec. 51. In order to encourage the beneficial use of remediated groundwater, "the department of water resources shall account for groundwater withdrawn pursuant to approved remedial action projects under CERCLA or title 49, Arizona Revised Statutes, consistent with the accounting for surface water" for purposes of determining compliance with management plan conservation requirements. Laws 1997, Ch. 287, Sec. 51(B).

- "For each calendar year until 2025, the use of up to an aggregate of sixty-five thousand acre-feet of groundwater withdrawn within all active management areas pursuant to approved remedial action projects under CERCLA or Title 49, Arizona Revised Statutes, shall be considered consistent with the management goal of the active management area as prescribed in section 45-576, subsection I, paragraph 2, Arizona Revised Statutes." Additionally, in the third management period, 50 percent of the total volume of groundwater withdrawn pursuant to remedial action projects and in excess of the aggregate volume of 65,000 acre-feet shall be considered consistent with the management goal of the AMA. Laws 1997, Ch. 287, Sec. 52.

- "The department of environmental quality and the department of water resources shall develop a method of sharing data, including cooperative data base development and integration between the departments, that will provide the departments with the information necessary to protect the resources of the state." Laws 1997, Ch. 287, Sec. 53.

- "The directors of environmental quality and water resources shall enter into an agreement to coordinate the well inspection and remediation programs and to rank wells within an area of contamination according to each well's potential to act as a conduit to spread contamination and to determine the appropriate remedial action regarding the wells with a potential to act as a conduit, including well reconstruction, well abandonment or no action." Laws 1997, Ch. 287, Sec. 54.

7.4 THE REGULATION OF GROUNDWATER QUALITY IN ARIZONA

To understand the Department's role in regulating groundwater quality, it is important to understand the broad framework of laws and programs impacting both groundwater and surface water quality. Since groundwater quantity and quality issues are so interrelated, ADEQ and the Department work together to prevent and mitigate groundwater quality and quantity problems. ADEQ has the lead role in protecting the State's groundwater quality and surface water quality, while the Department secondarily manages groundwater quality concerns. This section discusses the regulatory agencies responsible for administering laws impacting groundwater and surface water quality as well as the federal laws and state programs impacting groundwater and surface water quality.

7.4.1 Water Quality Regulatory Agencies

Water quality protection programs in Arizona are based on both federal and state law and are primarily administered by either ADEQ or the United States Environmental Protection Agency (EPA) Region IX. ADEQ has the responsibility to administer state water quality programs pursuant to state statutes and to administer federal water quality programs for which the EPA has delegated its authority to the state, sometimes referred to as state primacy. EPA has the responsibility to administer federal water quality programs pursuant to federal statutes, but may delegate its authority to states that demonstrate the ability to administer such programs.

ADEQ has authority pursuant to the Arizona Environmental Quality Act (EQA) of 1986 to set water quality standards and to regulate discharges that may impact the quality of groundwater by requiring a discharger to obtain an Aquifer Protection Permit (APP). ADEQ also has authority over remediation of contaminated groundwater under WQARF. ADEQ has authority under the Clean Water Act (CWA) to set Arizona's surface water quality standards and to certify that discharges subject to federal permits do not violate state water quality standards. Moreover, ADEQ has authority to regulate drinking water under the Safe Drinking Water Act (SDWA) and hazardous waste under the Resource Conservation and Recovery Act (RCRA).

EPA Region IX retains authority to administer the CWA National Pollutant Discharge Elimination System (NPDES) permits and the pretreatment program, while the United States Army Corps of Engineers, Los Angeles District, has authority to administer CWA permits for the discharge of dredge or fill materials in Arizona's waters. EPA Region IX also has authority to require groundwater monitoring and remediation in accordance CERCLA.

7.4.2 Federal Laws Impacting Groundwater Quality

The SDWA is the primary federal law regulating groundwater quality. In particular, it regulates drinking water from all sources including groundwater. The CWA, which regulates surface water, also impacts groundwater quality. CERCLA and the RCRA impact groundwater management through the regulation of hazardous waste and sites contaminated by hazardous waste. Following is a brief overview of these federal laws and their impacts on the Department's water quality management.

7.4.2.1 Safe Drinking Water Act

The SDWA was enacted in 1974 to regulate drinking water. ADEQ has been delegated authority by the EPA to implement the SDWA and "to ensure that all potable water distributed or sold to the public through public and semipublic water systems is free from unwholesome, poisonous, deleterious, or other foreign substances and filth or disease causing substances or organisms." A.R.S. § 49-351(A).

There are two types of standards set by the SDWA: national primary drinking water regulations and national secondary drinking water regulations. National primary drinking water standards may either be primary Maximum Contaminant Levels (MCLs) or Treatment Techniques (TT) requirements. Primary MCLs are the maximum permissible level of a constituent in a public water system and constitute the enforceable standard for safe drinking water. TT requirements set action levels for constituents such as lead and copper that cannot be directly detected or removed by water systems. National secondary drinking water regulations, referred to as secondary MCLs, set non-enforceable numeric standards for the aesthetic quality of the water, such as taste, odor, or color. Water with contaminants above the secondary MCLs are not typically expected to cause health problems. ADEQ has adopted the EPA MCLs as state Drinking Water Standards and has the authority to adopt more stringent standards as well.

Although the Department does not directly regulate drinking water quality, the presence of contaminants that exceed federal and state standards impacts the regulation of municipal providers and poses significant water management issues for drinking water systems.

7.4.2.2 Clean Water Act

The CWA, first passed in 1972, is the comprehensive federal statute regulating surface water quality. The CWA contains six major elements: (1) the NPDES permit program which regulates discharges of pollutants by any person to the nation's waters and is designed to protect the chemical and biological integrity of the nation's waters, (2) technology-based effluent standards that apply to the quality of a facility discharge, (3) state ambient water quality standards, (4) dredge and fill permits designed to protect the physical and biological integrity of the nation's waters, (5) oil and hazardous substance spill liability, and (6) federal grant programs for improvement of municipal water treatment.

Under the NPDES permit program, all point source dischargers of pollutants into "waters of the United States" must obtain a permit. The jurisdictional reach of the CWA extends to "navigable waters" which are defined as "waters of the United States, including the territorial seas." 33 U.S.C. § 1362(7). EPA and the Corps define "waters of the United States" to include interstate waters; waters which are used, were used in the past, or may be susceptible to use in interstate or foreign commerce; waters the use, degradation, or destruction of which would or could affect interstate or foreign commerce; tributaries to such waters; the territorial sea and wetlands. 40 C.F.R. §122.2; 33 C.F.R. § 328.3(a). A frequently cited definition of "waters of the United States" is

> any waterway within the United States also including normally dry arroyos through which water may flow, where such water will ultimately end up in public waters such as a river or stream, tributary to a river or stream, lake, reservoir, bay, gulf, sea or ocean within or adjacent to the United States. *U.S. v. Phelps Dodge Corp.*, 391 F. Supp. 1181 (D. Ariz. 1975).

Based on this "tributary rule," the CWA has potential application to dry land which drains into a water of the United States. Additionally, EPA interprets waters of the United States to include wetlands, areas susceptible to use as habitat by migratory wildfowl, and areas where industries engage in interstate commerce discharge. 44 Fed. Reg. 32854, 32858 (June 7, 1979); 51 Fed. Reg. 41206, 41217 (Nov. 13, 1986). "Point source" means:

> any discernible, confined, and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal

feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. 33 U.S.C. § 1362(11).

"Pollutant" includes dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water. 33 U.S.C. § 1362(6). Based on the expansive definitions of "waters of the United States," "point source," and "pollutant," the jurisdictional reach of the CWA NPDES Program is quite broad. The EPA has also implemented a NPDES storm water permit program that regulates municipal and industrial runoff which eventually discharges to waters of the United States.

NPDES permits that allow discharges to canals or river systems as a result of remedial projects or by wastewater treatment facilities are important to the Department's overall water management strategy. As a result, the Department provides input on related reports and draft NPDES permits that may impact the water management activities in the state. Furthermore, non-point source contamination of groundwater by such substances as nitrate, sulfate, and dissolved solids can render large volumes of groundwater unusable for many purposes and pose serious water management problems. Therefore, the Department monitors statutory and programmatic developments as well as permits and reports related to non-point source discharges under the CWA.

The CWA also provides for area-wide long range planning processes to mitigate water quality control problems in selected areas which result from urban and industrial wastewater. Because such planning processes include a comprehensive review of wastewater treatment and reuse options, the Department participates in this planning process and provides technical assistance to the local councils of government administering the plans.

7.4.2.3 Comprehensive Environmental Response, Compensation, and Liability Act

CERCLA and the Superfund Amendments and Reauthorization Act, commonly referred to as the federal Superfund program, authorize investigation and remediation of groundwater contaminated by releases of hazardous substances. Groundwater remediation may be required to comply with primary MCL standards, although less stringent standards may be approved by EPA on a case-by-case basis through a technical waiver process. In Arizona, CERCLA establishes a comprehensive response program which is administered by ADEQ in cooperation with the EPA. The Department also plays an advisory role in this process.

Under Section 105 of CERCLA, the EPA is required to annually update the National Priority List (NPL) of Superfund sites. Sites are proposed for inclusion on the NPL after being assessed as to the release of hazardous substances that threaten public health and the environment. Two significant components in the Superfund process are site investigation (Remedial Investigation) and evaluation of possible cleanup alternatives (Feasibility Study). During the Remedial Investigation, information is gathered to determine the general nature, extent, and sources of contamination at a site. Once the final cleanup plan has been selected, EPA formalizes this decision by signing a "Record of Decision" (ROD). The ROD also contains a Responsiveness Summary which is EPA's response to public comments on the Remedial Investigation, Feasibility Study, and Proposed Plan. Design and actual cleanup activities (Remedial Design and Remedial Action) can then proceed.

The Department regularly participates in CERCLA Program activities, primarily for sites located within AMA boundaries. The Department's concern at CERCLA sites is that any groundwater withdrawn and remediated be put to reasonable and beneficial use. The Department participates on CERCLA technical committees and serves in an advisory capacity for monitoring and extraction well installation, source control projects, and permitting.

7.4.2.4 Resource Conservation and Recovery Act

The RCRA established a national hazardous waste management program in 1976. Under RCRA, hazardous waste permits are issued for the treatment, storage, and disposal of hazardous wastes. Individual permits issued to these facilities specify design, performance, and operational standards which include groundwater monitoring. Hazardous waste facilities also undergo a closure process once operations are reduced or terminated. Moreover, corrective action may be required at treatment, storage, and disposal facilities and may include groundwater monitoring.

ADEQ has been delegated authority for the implementation of RCRA requirements in Arizona. The Department's participation at RCRA sites is important for water management activities, particularly in regard to well siting, use permits, and end use issues.

7.4.3 ADEQ Groundwater Programs

The EQA (A.R.S. § 49-101, *et seq.*) established the ADEQ and created a strong and comprehensive water quality management structure. ADEQ's programs that protect groundwater resources include water quality assessments, groundwater monitoring, pollutant discharge monitoring, permitting activities, and remediation activities. The following are selected water quality protection programs which fall under the jurisdiction of ADEQ and have a direct impact on Department activities.

7.4.3.1 Aquifer Water Quality Standards

Arizona's Aquifer Water Quality Standards (AWQSs) are the cornerstone of the State's groundwater protection program. Arizona has adopted the federal primary MCLs, established under SDWA, as numeric AWQSs. A.A.C. R18-11-406. These standards apply to aquifers that are classified and protected for drinking water use. Because all aquifers in Arizona are classified and protected for drinking water use, Arizona's AWQSs are enforceable water quality standards in all of Arizona's aquifers. A.R.S. § 49-224(B).

ADEQ may reclassify an aquifer within an AMA, upon consultation with the appropriate Groundwater Users Advisory Council and upon conducting a public hearing, for a projected use other than drinking water if the identified aquifer is hydrologically isolated from the other aquifers or other portions of the same aquifer, water from the identified aquifer is not being used as drinking water, and the benefits to the public of the resulting water quality degradation outweigh the costs. A.R.S. § 49-224(c).

Arizona has also adopted narrative AWQSs to regulate pollutant discharges for which no numeric standards have been developed. Arizona's narrative AWQSs include the following: (1) a discharge shall not cause a pollutant to be present in an aquifer classified for a drinking-water-protected use in a concentration which endangers human health, (2) a discharge shall not cause or contribute to a violation of a surface water quality standard established for a navigable water of the state, and (3) a discharge shall not cause a pollutant to be present in an aquifer which impairs existing or reasonably foreseeable uses of water in an aquifer. A.A.C. R18-11-405.

7.4.3.2 Aquifer Protection Program

The most comprehensive ADEQ groundwater protection program is the APP system, established by the EQA in 1986 and implemented by rule in 1989. An individual or general permit is required for any person who discharges or who owns or operates a facility that discharges a pollutant from a facility either directly into an aquifer or to the land surface or the vadose zone in such a manner that there is a reasonable probability that the pollutant will reach an aquifer. A.R.S. §§ 49-201(11), 49-241. Discharging facilities that require either an individual or general permit to operate include surface impoundments, solid waste disposal facilities, injection wells, land treatment facilities, facilities which add a pollutant to an assortment of salt formations, dry well, or underground cave or mine; mine tailings piles and ponds, mine leaching operations, large septic tank systems, effluent recharge projects, point source discharges to waters of the United States, and sewage or sludge ponds and wastewater treatment facilities. A.R.S. § 49-241(B). Classes or categories of facilities which are exempted from APP requirements are identified in A.R.S. § 49-250. General permits are issued by rule while individual permits must be applied for on a facility by facility basis.

APPs require a demonstration that AWQSs are maintained and the Best Available Demonstrated Control Technology (BADCT) is applied. For individual APPs, compliance with AWQSs is measured at a designated point of compliance. BADCT requirements ensure that the greatest degree of discharge reduction is achieved through an evaluation of site-specific engineering, environmental, and economic criteria.

APPs may require compliance with best management practices (BMPs). BMPs are typically site design techniques used to protect water quality. BMPs may be adopted to manage urban runoff, storm sewers, silvicultural activities, and septic tank systems. Agricultural general permits require compliance with BMPs for nitrogen fertilizer application and concentrated animal feeding operations. ADEQ is required to monitor compliance with the established BMPs and to measure BMP effectiveness.

Department staff receives and reviews all APPs for any impacts on Departmental programs and water management. In particular, the Department coordinates with ADEQ to review APP applications for potential harmful water quality impacts on groundwater conditions. Pursuant to A.A.C. R18-9-109, ADEQ advises the Department of each APP application received for a facility that is a recharge project or an underground storage and recovery project. One of the conditions for the issuance of an underground storage facility permit is that ADEQ must determine that the facility is not in a location which will result in pollutants being leached to the groundwater table so as to cause unreasonable harm. A.R.S. § 45-811.01(C). Facilities exempt from APP provisions may be required by the Department, in consultation with ADEQ, to meet other requirements to mitigate harmful water quality impacts to the aquifer.

7.4.3.3 Wellhead Protection Program

ADEQ's Wellhead Protection Program is an important supplement to groundwater quality protection provided by the Department's well construction standards and well driller licensing programs. The Wellhead Protection Program fulfills federal requirements of Section 1428 of the SDWA by designating Wellhead Protection Areas around public drinking water systems. The Wellhead Protection Program is a voluntary program which encourages the protection of all wells, not just public drinking water system wells. Local entities that have the authority to control land use and exercise other management options can implement wellhead protection, therefore encouraging the creation of local programs.

7.4.3.4 Reuse Permits

Reuse permits are issued to facilities which provide wastewater for reuse. A reuse permit specifies the amount of effluent to be reused and its chemical quality. ADEQ wastewater reuse rules (A.A.C. R18-9-701, *et seq.*) set the criteria for the use of treated effluent, or reclaimed water, for purposes such as agricultural irrigation, turf irrigation, and recharge. The current reuse rules prescribe numeric reclaimed water quality criteria and monitoring requirements for specific reuse applications. In general, these rules prescribe allowable limits for pH, total fecal coliform, turbidity, enteric viruses, and certain parasites. Reuse may be limited depending on the quality of source water and the intended use.

Wastewater reuse rules undergo periodic updating through ADEQ's rule-making process. The Department reviews any proposed changes to the wastewater reuse rules to ensure the protection of public health and groundwater supplies while maximizing the use of a significant renewable water supply. The Department evaluates effluent reuse permits issued by ADEQ and encourages the use of treated effluent where appropriate.

7.4.3.5 Underground Storage Tanks

ADEQ's Underground Storage Tank (UST) Program was developed to ensure the proper operation of USTs and to prevent and remediate releases. Under state regulation and RCRA amendments, the UST Program consists of notification requirements, technical standards for new and existing USTs, leak detection and closure criteria, corrective actions for remediation and financial responsibility demonstrations. Leaking USTs in a concentrated area can have detrimental impacts on groundwater quality and supplies.

The Department has the authority to issue poor quality groundwater withdrawal permits for water contaminated by USTs. The Department can provide guidance for UST site remediation projects to ensure the beneficial use of remediated water.

7.4.3.6 Water Quality Assurance Revolving Fund

The WQARF Program, sometimes referred to as the state Superfund program, was created as part of the EQA. WQARF monies are used to protect the waters of our state against hazardous substances and may be used in conjunction with federal funds. Funds can be used for statewide water quality monitoring, health and risk assessment studies, and remediating hazardous substances which threaten the waters of the state. Mitigation of non-hazardous substances is also allowed under specified conditions. A.R.S. § 49-286. Each year, ADEQ develops a list of environmentally threatened sites which qualify for WQARF monies which is based in part on the degree of risk to the environment and other available funding sources. Funds are used at those sites to mitigate existing contamination or to prevent further spread of pollutants that may threaten water supplies.

Some of the key legislative changes made in the 1997 WQARF reform package include: (1) establishment of a proportional share liability for cost allocation to responsible parties; (2) creation of a neutral party arbitration process, with incentives to encourage early settlements and disincentives to responsible parties who do not enroll in the neutral party arbitration process; (3) new ADEQ funding mechanisms designed to protect existing wells against migrating contamination from WQARF sites; (4) the creation of a comprehensive WQARF site registry, which consolidates a number of separate lists which were previously used; (5) the inclusion of petroleum releases in the WQARF Program under some circumstances; and (6) increased flexibility in the selection of groundwater remedies.

ADEQ follows a process for management and cleanup of WQARF sites which consists of site identification and characterization, site prioritization, remedy selection, identification of end uses, implementation and monitoring, and closure. The criteria used to evaluate of response actions include practicability, risk, cost, and benefit. This process also includes a comparison of alternatives based on established statutory criteria, developing a Remedial Action Plan (RAP), obtaining public comment, and issuing a ROD. The Department will actively coordinate with ADEQ in the planning and implementation of groundwater cleanup actions under WQARF.

7.4.3.7 Water Infrastructure Finance Authority

In 1989, the Arizona legislature created the Wastewater Management Authority to administer funds granted to the state pursuant to the federal SDWA. These funds, which required a 20 percent state match, were loaned to wastewater treatment facilities for assistance in meeting the SDWA requirements. The ADEQ made loans for this purpose from monies in the ADEQ wastewater treatment revolving fund.

In 1997, this administrative body was amended by the legislature and renamed the Water Infrastructure Finance Authority (WIFA). The authority of WIFA was expanded to make loans available to drinking water systems in addition to wastewater treatment systems for assistance in meeting requirements of the SDWA. The state funding source was also changed so that monies made available to these systems are now derived from the drinking water revolving fund. The Department participates on the advisory board which oversees the WIFA and has an interest in viability of water systems and SDWA compliance.

7.4.4 The Department's Programs Related to Groundwater Quality

The Department protects groundwater quality by considering groundwater quality issues in its permitting process and water quantity management programs. As a result of WQARF reform legislation in 1997, the Department has increased its responsibility in the program to coordinate and provide assistance to WQARF activities. Among other things, the bill provides for:

- annual funding for Department WQARF activities;
- database development and coordination with ADEQ;
- groundwater withdrawn pursuant to certain cleanups to be accounted for in the same manner as surface water for the purpose of determining compliance with conservation requirements;
- amendment of the Assured Water Supply Rules (AWS Rules);
- active involvement by the Department in all phases of site assessment, remediation, management, operation, and planning strategies;
- a WQARF Advisory Board on which the Department has a seat; and
- a well inspection program through which wells that are contributing to vertical cross-contamination may be identified and modified.

The Department's existing permits and programs that involve groundwater quality issues as well as its new programs for groundwater quality protection based on the WQARF legislation are discussed in the following subsections.

7.4.4.1 Poor Quality Groundwater Withdrawal Permits

Appropriate use of poor quality groundwater conserves the existing supply of potable groundwater. The Department issues poor quality groundwater withdrawal permits to allow the withdrawal of groundwater that, because of its quality, has no other beneficial use at the present time. A.R.S. § 45-516. Withdrawal permits are issued by the Department, and the withdrawal must be consistent with the AMA management plan. Permits are usually issued in conjunction with CERCLA, WQARF, or leaking UST sites for pump and treat operations. To increase the appropriate uses of poor quality groundwater during the third management period, the Department will continue to encourage matching poor quality groundwater with beneficial uses within the AMA.

7.4.4.2 Assured Water Supply Program

The Assured Water Supply Program (AWS Program) is a consumer protection program that ensures that new subdivisions have a secure supply of water with adequate quality for at least 100 years. The AWS Program is described in detail in Chapter 5, section 5.3.

In assessing the quality of a water supply pledged for assured water supply purposes, the Department works closely with ADEQ to determine whether the water supply meets ADEQ standards for the purposes for which the water is pledged. If the water is not of adequate quality, the applicant may need to find alternative water sources or expend additional resources treating the water to meet the ADEQ standards.

7.4.4.3 Underground Water Storage and Recovery

Underground water storage, also known as recharge, may be helpful in maintaining safe-yield conditions and preventing long-term declines in water table levels in the Santa Cruz AMA. The underground water storage program is administered by the Department and described in detail in chapter 8, section 8.3. Permits must be obtained from the Department prior to undertaking recharge activities. The Department coordinates closely with ADEQ to ensure that underground water storage does not adversely impact existing aquifer water quality and does not cause movement of existing groundwater contamination. If effluent is stored underground, the applicant must obtain an APP from ADEQ, in addition to the underground storage permits required from the Department.

7.4.4.4 Well Spacing/Impact Analysis

A.R.S. § 45-598 and the Department's temporary general Well Spacing and Well Impact Rules require well impact studies to evaluate the potential for new non-exempt wells and new withdrawals to damage land and other water users, particularly existing well operations. The Department conducts the impact studies for wells with a maximum discharge of 500 gallons per minute (gpm) or less. For wells with a maximum discharge rate exceeding 500 gpm, the permit applicant must submit a hydrological study of projected water level declines due to the operation of the proposed well. The study must also assess potential adverse impacts from the migration of poor quality groundwater. The well permit application may be denied if the Department determines that the proposed well would cause an unreasonable and adverse impact on surrounding wells, additional regional land subsidence, or migration of poor quality groundwater. Wells which withdraw less than 35 gpm are currently exempt from these requirements.

7.4.4.5 Well Construction and Abandonment Requirements and Licensing of Well Drillers

If wells are not constructed, sealed, or abandoned properly they can act as conduits for contaminant flow from the surface to groundwater or between aquifers. The Department's rules governing well construction, abandonment, and driller licensing, set forth at A.A.C. R12-15-801, *et seq.*, are summarized below.

- Minimum well construction and abandonment requirements prevent entry of fluids at and near the surface and minimize the possibilities of migration and inadvertent withdrawal of poor quality groundwater. These requirements also prohibit the use of hazardous materials in the construction of wells.

- Installation, modification, abandonment, or repair of all wells in Arizona must be performed by a driller licensed by the Department. The licensing procedure includes the administration of written examinations to test the applicant's knowledge of state regulations, hydrologic concepts, and well construction principles and practices.

- Disposal site restriction prevents the use of wells as disposal facilities for any material that may pollute groundwater.

- Special standards may be required by the Department if the minimum well construction requirements do not adequately protect the aquifer or other water users.

- Open wells must be capped with a water-tight steel plate.

- Except for monitor and piezometer wells, no well shall be drilled within 100 feet of any septic tank system, sewage disposal area, landfill, hazardous waste facility or storage area, or petroleum storage areas and tanks, unless authorized by the director.

Wells drilled prior to the enactment of the well construction rules (effective March 5, 1984) were not required to be constructed in accordance with minimum well construction standards. If a pre-rule well is replaced or modified, however, the new or modified well must meet the current well construction standards. See A.R.S. § 45-594.

7.4.4.6 The Department's Role in the WQARF Program

The Department's involvement in groundwater remediation has been redefined in the WQARF reform bill as a result of recommendations made by the Groundwater Cleanup Task Force, which conducted an extensive series of stakeholder negotiations designed to promote groundwater cleanup and groundwater quality management activities of remedial sites. Involvement in this development process was widespread and representative of a varied group of private and public interests.

7.4.4.6.1 Department Activities in the WQARF Site Cleanup and Management Process

ADEQ's WQARF site cleanup and management process and the Department's role in that process are described in the following discussion.

Site Identification and Characterization

Existing WQARF sites have been identified and are being managed by ADEQ. Additional sites may be identified in the future based on a preliminary investigation by ADEQ to determine the potential risk to public health, welfare or the environment. The Department will further assist ADEQ in this process by providing resource data which includes well location and pumpage records, water rights information, and any other appropriate data recorded by the Department.

Characterization of sites is important because the nature and extent of contamination must be understood before remedies can be selected and implemented. An important part of site characterization is an evaluation of how contamination impacts current and future groundwater uses. The Department's role may include such activities as site inspections and evaluations, review of investigations, field work such as well inspection and water quality sampling, identification of potential water management issues, and any other characterization as appropriate. Department computer models may be useful in characterizing groundwater flow patterns.

Site Prioritization

The results of the preliminary investigation will be used by ADEQ for site scoring using a method to be established in rules adopted by the ADEQ director. The completed preliminary investigation will be used by ADEQ to either make a determination of no further action on a site, or to prepare the site for inclusion on the Site Registry. In this latter case, a Site Registry report is prepared containing a description of the site, with its geographical boundaries indicated, and a score in accordance with the site scoring method to be established in rules and adopted by the ADEQ director. The Department will assist ADEQ by sharing pertinent water resource information.

Remedy Selection

ADEQ has established a list of response actions to be considered when managing a site. Based on the potential impact on current and future water uses, remedial action options must be evaluated and a RAP developed. Each RAP is site-specific. The Department will assist in defining potential remedies to ensure the remedial approach is consistent with Department water management objectives and sound groundwater management practices that are publicly acceptable. The Department's level of assistance will vary based on the remedy selected. Possible remedies are listed in Appendix 7C.

Identification of Beneficial End Uses

The Department is committed to the beneficial use of groundwater withdrawn and treated at WQARF sites, along with other areas that have degraded groundwater quality. The Department will assist ADEQ with the identification and facilitation of designated end uses for remedial projects. These end uses should be consistent with those determined for existing sites as well as the development of new end uses to match the intended use.

Implementation and Monitoring

The implementation and monitoring phase of a site activity includes construction, startup, monitoring, operation and maintenance, and any other appropriate activities. The Department will assist ADEQ in this phase through the following activities where appropriate: field work, review of groundwater analyses, pertinent groundwater and assured water supply accounting, and any other appropriate activities.

Site Closure

ADEQ must certify that site goals have been attained in order to discontinue cleanup activities. Department staff will assist in evaluation of sites and certification of site closure. The Department may need to identify alternative water sources to replace remediated water when sites are closed.

7.4.4.6.2 Department Policies for WQARF Site Cleanup and Management

In general, site cleanup plans should be consistent with the management goals of the AMA in which the site is located. A.R.S. §§ 49-282.06(F); 45-105(B)(4)(c). Therefore, the Department will implement policies during the third management period for the management and cleanup of remedial sites in cooperation with ADEQ. These policies will ensure that AMA goals are addressed when remedial actions are planned. The Department supports proposed remedial projects when they are appropriate, but believes that RAPs must make sense from a groundwater management perspective. The principles which will be used to formulate these policies are described below:

- **Water should be used consistent with water allocation concepts in Title 45.**

This policy requires that entities using water withdrawn pursuant to cleanups, whether under CERCLA, WQARF, RCRA, voluntary, or other sites, possess appropriate authorities for the use of groundwater (such as permits or water rights).

- **The Department supports source control cleanups to protect water sources.**

Source control, which controls pollution at its source, can be the most cost effective and practicable approach to cleanups. Source control projects to protect wells that are threatened by contaminant migration are generally supported by the Department. Pollution prevention is also a significant component of mitigating contaminant migration.

- **Any groundwater withdrawn must be put to reasonable and beneficial use.**

Reasonable and beneficial use of groundwater withdrawn is a policy that applies to all groundwater remediation efforts. Any withdrawals of 100 acre-feet or less per year may qualify for de minimis status and be exempted from beneficial use requirements, but the Department will evaluate de minimis exemptions from this policy on a case-by-case basis. In the case of leaking UST sites, the Department generally exempts sites that annually pump less than 10 or 15 acre-feet. The de minimis policy also facilitates the handling of small volumes of water pumped for the collection of groundwater sampling.

- **Contaminated groundwater represents a resource that has future importance.**

Contaminated groundwater is a resource that may be used for both potable and nonpotable uses. Potable uses must meet state and federal standards which regulate public consumption of drinking water. ADEQ and the Arizona Department of Health Services intend to develop end use standards for non-potable uses that, if implemented, will make large volumes of contaminated groundwater usable for specific purposes. The Department will cooperate in the development of non-potable end use standards and will develop policies for appropriate end uses based on the new standards.

- **Containment remedies that involve massive groundwater withdrawals to achieve regional groundwater flow control are generally inappropriate and will not be supported by the Department.**

In some cases, massive groundwater withdrawals of uncontaminated or only slightly contaminated water may be considered in order to control migration of contaminant plumes or for other purposes. In general, the Department considers these kinds of proposed remedies to be wasteful of groundwater and not cost-effective.

7.4.4.6.3 Statutory Mandates for the Department's Involvement in the WQARF Program

The 1997 WQARF reform legislation mandates that the Department implement certain water quality programs and provides for expanded Department involvement in water quality management. New Department programs and responsibilities based on the 1997 WQARF reform legislation include the following:

- **Remediated Groundwater Incentives**

The WQARF reform legislation of 1997 directs the Department to include in the management plans developed pursuant to A.R.S. § 45-566 (the Third Management Plans) provisions to encourage the beneficial use of groundwater that is withdrawn pursuant to approved remedial action projects under CERCLA or Title 49, Arizona Revised Statutes. Laws 1997, Ch. 287, § 51(A).

Remediated Groundwater Incentive for Conservation Requirement Accounting

In order to encourage the beneficial use of remediated groundwater, the Legislature specifically mandated:

> In determining compliance with applicable conservation requirements adopted pursuant to sections 45-566, 45-567 and 45-568, Arizona Revised Statutes, the department of water resources shall account for groundwater withdrawn pursuant to approved remedial action projects under CERCLA or Title 49, Arizona Revised Statutes, consistent with the accounting for surface water.
>
> Laws 1997, Ch. 287, § 51(B).

Remediated Groundwater Incentive for Assured Water Supply Accounting

In addition, the WQARF reform legislation of 1997 directs the Department to consider specified amounts of groundwater withdrawn pursuant to approved remedial action projects as consistent with the management goal of the active management area from which it is withdrawn for purposes of the Department's AWS Program. Laws 1997, Ch. 287, § 52. The Legislature mandated that:

> For each calendar year until 2025, the use of up to an aggregate of sixty-five thousand acre-feet of groundwater withdrawn within all active management areas pursuant to approved remedial action projects under CERCLA or Title 49, Arizona Revised Statutes, shall be considered consistent with the management goal of the active management area.
>
> Laws 1997, Ch. 287, § 52(A).
>
> Once the aggregate volume of 65,000 acre-feet of remediated groundwater use by all users in all active management areas is reached in a year, the use of an additional amount of remediated groundwater is consistent with the management goal of the active management area based on a sliding scale. In the third management period, fifty percent of the total volume withdrawn in excess of the 65,000 acre-feet will be consistent with the management goal. Laws 1997, Ch. 287, § 52(B). By the year 2025, the remediated groundwater incentive for assured water supply accounting decreases to zero.

A municipal provider must apply for remediated groundwater accounting for an assured water supply determination prior to January 1, 2010. The amount of groundwater determined to be consistent with the management goal cannot exceed the amount that the municipal provider is legally obligated to withdraw or use and does not extend beyond 2025. Laws 1997, Ch. 287, § 52(C).

In AMAs where a mined groundwater account is created as part of an assured water supply determination (Phoenix, Tucson, and Prescott) annual groundwater withdrawals of 250 acre-feet or less that are withdrawn pursuant to an approved remedial action project shall not be debited against the mined groundwater account and shall not be subject to a replenishment obligation. The water provider must notify the Department of its compliance with this exemption. Annual withdrawals of 250 acre-feet or less of remediated groundwater will not count against the 65,000 acre-feet per year total volume. Laws 1997, Ch. 287, § 52(E).

Coordination with ADEQ in Evaluating Proposed Remedial Actions

Pursuant to A.R.S. § 45-105(B)(4)(c), the Department is required to actively coordinate and confer with ADEQ in evaluating proposed remedial actions to provide ADEQ with information regarding water resource considerations. The Department will coordinate and confer with ADEQ prior to ADEQ's approval or denial of a proposed remedial action project. Once a remedial action project is approved by ADEQ or the EPA pursuant to CERCLA or Title 49, A.R.S., the Department will account for remediated groundwater in accordance with Laws 1997, Ch. 287, §§ 51 and 52.

Among other things, the Department will consider the following factors relating to proposed remedial actions in its recommendations to ADEQ:

1) Volume of remediated groundwater to be withdrawn

The Department will encourage remedial actions that use the least amount of groundwater necessary to facilitate a project's remedial goal and will discourage remedial actions that are not prudent and efficient from a groundwater management perspective.

2) End uses to which remediated groundwater will be put

The Department will encourage end uses that are consistent with the AMA goals. Where remediated groundwater cannot be practicably or cost effectively re-injected or recharged, the Department will encourage replacing existing groundwater uses with remediated groundwater and preventing new permanent uses which would not have occurred without the incentive to use remediated groundwater and which would continue to rely on groundwater after the remediated groundwater is no longer available.

While individual circumstances will be evaluated on a case-by-case basis, generally, the Department's beneficial end use preferences are that the water would either be re-injected or recharged in the same local area or that existing groundwater uses would be replaced with use of remediated groundwater in the same local area.

Achievement of maximum beneficial use of waters and viability of proposed remedial action

Remedial actions must assure the protection of public health and welfare and the environment to the extent practicable, provide for the control, management or cleanup of hazardous substances so as to allow the maximum beneficial use of the waters of the state to be reasonable, necessary, cost-effective and technically feasible. A.R.S. § 49-282.06(A).

Consistency with Title 45

Groundwater withdrawn pursuant to an approved remedial action must be withdrawn and used consistent with Title 45, Arizona Revised Statutes.

- **Well Inspection, Modification, or Replacement**

The Department is required by the 1997 WQARF legislation to develop rules for well inspections. An evaluation of the extent of the cross-contamination problems will be performed by the Department in cooperation with ADEQ and other stakeholders.

- **Construction of New Wells In and Near WQARF Sites**

The 1997 WQARF legislation mandates that the Department ensure that new or replacement wells located in areas of known groundwater contamination are constructed in such a manner that cross-contamination does not occur. Department staff will screen Notices of Intent to Drill, including exempt wells, submitted to help ensure that wells are properly constructed. The Department will establish policies and procedures to implement this directive, including procedures to effectively communicate with well owners and drillers.

- **Abandonment of Wells In and Near WQARF Sites**

Department staff will review and evaluate Notices of Intent to Abandon to ensure that abandonment of wells is done in accordance with Department rules and that potential for cross-contamination is minimized.

7.5 WATER QUALITY ASSESSMENT

A water quality assessment must be included in management plans pursuant to the Code. The assessment provides an overview of water quality concerns in the Santa Cruz AMA. The following sections discuss the assessment goals and objectives, water quality of renewable and groundwater supplies, constituents of concern in the Santa Cruz AMA and their impact on water management, and specific contamination areas in the Santa Cruz AMA.

7.5.1 Assessment Goals and Objectives

The primary goal of the Third Management Plan Water Quality Assessment is to provide a general evaluation of groundwater and surface water quality conditions in the Santa Cruz AMA and to identify the interface of water quality concerns with water supplies. The impact of water quality on water resource management has become more important in recent years due to such factors as stringent water quality standards, conjunctive use of water supplies, groundwater management at remediation sites, and increasing levels of public concern.

The municipal, agricultural, and industrial sectors have distinctive demand patterns and water quality requirements. For example, state law prohibits direct use of treated effluent for potable use, but treated effluent can be used for turf irrigation, agricultural irrigation, cooling towers, and groundwater recharge. Water high in total dissolved solids (TDS) may be inappropriate for agricultural irrigation but may be used for some industrial applications. Water high in nitrate could be suitable for agriculture, but does not meet potable standards. During the third management period, the Department will evaluate matching water quality characteristics with appropriate end uses while ensuring compliance with applicable laws and rules for each end use.

7.5.2 Renewable Water Supplies

Other than effluent, surface water flow is a source of renewable water in the Santa Cruz AMA. The quality of surface water and effluent supplies is discussed in this section.

7.5.2.1 Surface Water

Surface water quality in the Santa Cruz AMA is generally good. Surface water sources available for use in the Santa Cruz AMA include Patagonia and Peña Blanca lakes, intermittent and ephemeral flow in the microbasin and northernmost reaches of the Santa Cruz River and Nogales Wash, and the effluent-dominated reach of the Santa Cruz River. Water quality in Patagonia Lake is generally good. There have been some instances of mercury present in some fish in Peña Blanca lake, but this metal has not been detected in the water to date. The surface water in Nogales Wash is considered poor quality due mostly to sewer lines leaking in both Nogales, Sonora and Nogales, Arizona. The effluent dominated reach of the Santa Cruz River has a water quality that meets treated effluent water quality standards.

7.5.2.2 Effluent

Effluent is defined by A.R.S. § 45-101(4) as "water that has been collected in a sanitary sewer for subsequent treatment in a facility that is regulated pursuant to A.R.S. §§ 49-361 and 49-362. Such water remains effluent until it acquires the characteristics of groundwater or surface water." Sanitary sewers are comprised of any pipe or other enclosed conduit that carries any waterborne human wastes from residential, commercial, and industrial facilities. A.R.S. § 45-101(8).

Effluent treated at the Nogales International Wastewater Treatment Plant (NIWWTP) in Rio Rico treats municipal wastewater from both Mexico and Arizona and is a significant source of renewable water supply in the Santa Cruz AMA. Although not suitable for human consumption without advanced treatment, effluent is suitable for turf irrigation, agricultural irrigation, sand and gravel washing, and several other industrial applications. Wastewater reuse rules are developed by ADEQ and establish parameters for wastewater reuse options.

Effluent from the NIWWTP is discharged into the Santa Cruz River stream channel. The area from the plant downstream to Chavez Siding Road has a perennial flow and is considered to be the effluent dominated reach of the Santa Cruz River. Wastewater discharges require a NPDES permit to ensure that water quality parameters are being met.

7.5.3 Groundwater Supplies

Groundwater is one of the most important sources of water in Arizona. Most of the groundwater supplies in the Santa Cruz AMA are of acceptable quality for most uses. However, some aquifers have been degraded as a result of contamination.

The introduction of contaminants into aquifer systems degrades groundwater quality and threatens public health and the environment. Contaminants can migrate into areas of potable groundwater supplies due to groundwater pumping or regional groundwater flow patterns. Many areas of the Santa Cruz AMA are projected to remain dependent on groundwater pumping, thereby potentially causing migration of contaminants. The Department's role in managing potential contaminant migration is through involvement in site-specific and non-site specific water quality management.

Groundwater that has been degraded has limited beneficial uses due to chemical, biological, or radiological contamination and may have high treatment and delivery costs associated with its use. Despite these limitations, the Department considers poor quality groundwater to be a valuable resource for future water management and encourages appropriate uses of this water supply. Matching the highest beneficial use with poor quality groundwater is an important aspect of water management. Frequently, poor quality groundwater is remediated and reinjected into the aquifer because it is not economically feasible to convey the treated water to a location for a higher beneficial use.

Recognizing that there may be impacts resulting from surface water recharge, the EPA requires states to develop a rule for groundwater under the influence of surface water. ADEQ has adopted a rule (A.A.C. R18-11-405) which stipulates that groundwater under the direct influence of surface water requires more extensive treatment than groundwater.

7.5.4 Groundwater Constituents and Their Impacts on Water Quality Management

The management of water resources requires an understanding of how water quality impacts aquifer conditions and potential uses. Drinking water quality regulations are developed to ensure that the intended use will not have harmful impacts on human health. The Department and ADEQ evaluate water quality based on ADEQ's numeric and narrative AWQSs as well as EPA's primary and secondary MCLs, commonly expressed as mg/l or µg/l. Appendix 7A provides a more detailed list of primary MCLs for selected Volatile Organic Compounds (VOCs), pesticides, inorganic metals, radiochemicals regulated under the Arizona Drinking Water Rules, and other selected contaminants. Appendix 7A also includes a brief description of the potential human health effects and sources of these contaminants in drinking water.

Appendix 7B lists the secondary MCLs for selected contaminants. Secondary MCLs are non-enforceable aesthetic standards.

The following sections briefly describe the impact of selected constituents on groundwater management and public health. ADEQ's Arizona Water Quality Assessment was used as a reference for descriptions of the limitations on uses, present and planned remedial activities, and potential uses of poor quality groundwater for each constituent. The Department's own databases were used to describe water quality in the Santa Cruz AMA.

7.5.4.1 Nitrate

Nitrates are salts formed from nitrogen compounds and are one of the most common groundwater contaminants detected in Arizona. Low nitrate concentrations in groundwater may originate from natural sources such as organic acids. Elevated nitrate levels are generally attributed to industrial sources, wastewater treatment plants, septic tanks and leach fields, or agricultural fertilizers.

Water containing high levels of nitrate-nitrogen cannot be delivered as a drinking water supply unless it is equal to or reduced below the MCL of 10 mg/l. Adults can tolerate high levels of nitrate-nitrogen, although water containing more than several hundred mg/l can cause gastrointestinal irritation. Water that contains nitrate in concentrations in excess of the MCL can be harmful to infants. Nitrate may also be harmful to livestock at levels exceeding several thousand mg/l.

Nitrate stimulates plant growth and is typically regarded as a desirable constituent under most agricultural and turf-related watering uses. For this reason, effluent is often sought as a source of irrigation water. Nitrogen fertilizer application rates may be reduced or eliminated if irrigation water contains elevated nitrate levels.

Nitrate concentrations above the MCL of 10 mg/l have been detected in Nogales Wash at the international border.

7.5.4.2 Sulfate

Sulfate can occur as a natural inorganic constituent of groundwater which originates from the natural dissolution of minerals in aquifers. Elevated concentrations can result from the leaching of industrial wastes and agricultural fertilizers. High sulfate concentrations are often found in aquifers underlying current or historic agricultural lands, mining areas, and areas of natural mineralization.

The EPA has not established a primary MCL for sulfate. The EPA is schedules to complete studies of the human and health effects of sulfate and to decide whether to establish a drinking water MCL in August, 2002. The secondary MCL for sulfate is 250 mg/l.

Elevated sulfate concentrations in drinking water supplies can cause problems due to taste and laxative effects and can lead to scale formation in evaporative cooling systems. The diverse nature of industrial water quality requirements create specific needs for different industries. Some industries require very low sulfate levels while others can use water with elevated sulfate levels. High sulfate concentrations in groundwater do not commonly limit agricultural water use.

Sulfate levels above the secondary MCL are prevalent along the Nogales Wash and the Santa Cruz River downstream of the NIWWTP.

7.5.4.3 Total Dissolved Solids

TDS content is a measure of the dissolved minerals present in water and is a general indication of inorganic water quality. Components of TDS include inorganic compounds such as calcium, magnesium, sodium, potassium, sulfate, bicarbonate, chloride, and silica. In most areas, the primary components of TDS are derived naturally as groundwater dissolves minerals present in aquifers. TDS concentrations can also be elevated by agriculture, industry, and wastewater treatment facility discharges.

The EPA has established a secondary MCL of 500 mg/l for TDS. High TDS concentrations, which result in scaling and mineral accumulation, can have an adverse economic impact on water distribution systems and household plumbing and appliances. Though no permanent harmful effects have been observed from drinking high TDS water, some people may find the taste of this water to be less desirable than lower TDS water.

The concentration of TDS that limits water use varies widely among industries. High TDS water is a primary concern of a few industries (such as the semiconductor industry) that require water so pure they must treat almost any source water to obtain the necessary quality. Other industries, such as sand and gravel operations, can use water with very high TDS concentrations. The application of water containing high concentrations of TDS on turf-related facilities can impact turf quality and clog irrigation sprinkler heads if proper management techniques are not followed.

Water within the Santa Cruz AMA exhibits TDS concentrations at or below 500 mg/l. The highest concentrations are along the Nogales Wash and the Santa Cruz River downstream of the NIWWTP.

7.5.4.4 Metals

The EPA has designated 13 priority pollutant metals and has established primary MCLs for 10 of the metals that occur in drinking water: antimony, arsenic, barium, beryllium, cadmium, chromium, mercury, nickel, selenium, and thallium. The primary MCL for nickel has recently been remanded for further review by the EPA. The EPA promulgated primary MCL goals and National Primary Drinking Water Rules for lead and copper in June of 1991. High concentrations of metals in groundwater are typically associated with industrial wastes. Some metals occur naturally in groundwater, depending on the geology of the aquifer and the geochemical equilibrium between aquifer materials and groundwater.

The health effects associated with exposure to metals vary depending on the constituent and concentrations. Some metals such as selenium and chromium are known to be essential for human nutrition and are beneficial in certain concentrations. Others, such as lead, have no known beneficial effects on human or animal development and are harmful in high concentrations. Limitations on industrial and agricultural use of water with high concentrations of metals vary considerably depending on the contaminant present and the associated use.

Problems with metals are uncommon in the Santa Cruz AMA.

7.5.4.5 Volatile Organic Compounds

VOCs, such as trichloroethylene (TCE) and tetrachloroethylene (PCE), are chemicals that evaporate easily but do not readily dissolve in water. Other VOCs include acetone; vinyl chloride; 1,2-dichloroethane; benzene; 1,1-dichloroethylene; 1,1-dichloroethane; chloroform; toluene; and methylene chloride. VOCs are present in or are used for the manufacturing of, many substances including degreasers, solvents, plastics, paint, varnish, finish removers, detergent, medicine, and gasoline. When found in groundwater, VOCs are usually associated with industrial areas, landfills, and other sites used for the improper disposal of chemicals.

Health effects associated with VOCs in drinking water are complex and vary with the types of compounds and concentrations present. Some VOCs, such as TCE, are suspected human carcinogens while others have been associated with damage to internal organs. Drinking water supplies which exceed primary MCLs for VOCs must be treated prior to use.

The use of water containing VOCs for industrial and agricultural applications must be examined on an individual basis. Treatment processes for the removal of VOCs must be adequate to meet the intended use of the remediated water. Air quality regulations also need to be considered prior to the use of water contaminated with VOCs.

VOCs exceeding the MCLs are found at the RCRA site near the United Musical Instruments Plant (UMI) in Nogales and at several isolated locations along the Nogales Wash.

7.5.4.6 Petroleum Hydrocarbons

This class of contaminants includes non-halogenated hydrocarbons such as benzene, toluene, ethyl benzene, and xylenes, which are ingredients of gasoline and other fuels. Leaking underground fuel storage tanks and distribution systems are a common source of groundwater contamination by petroleum hydrocarbons. According to ADEQ, there are over 5,700 reported leaking UST systems in Arizona. Many of these leaking USTs have been investigated and remediated.

Leaking UST facilities have been identified in the Santa Cruz AMA. Some of these sites have affected water supplies but at levels at or below MCLs. The probable source of contamination at most of these locations is leaking tanks associated with gasoline stations, commercial, and industrial sites. The sites identified have varying degrees of groundwater contamination and are in various stages of remediation.

7.5.4.7 Pesticides

Pesticides are synthetic and natural organic chemicals which are used as insecticides, rodenticides, and herbicides. Pesticides may be detected in groundwater underlying areas irrigated for agriculture and turf grass.

The health effects of pesticide exposure in water are varied and complex, depending on both the pesticide's inert and active ingredients and reaction with substances contained in the water. Drinking water supplies can be affected by pesticide contamination. The presence of pesticides can restrict some industrial and agricultural water uses such as animal-based industries and vegetable production because elevated concentrations of pesticides may bioaccumulate (accumulate in living tissue) as they are passed through the food chain.

There are no known sites of pesticide concentrations in the Santa Cruz AMA.

7.5.4.8 Fluoride

Fluorides are compounds found in rocks and soil and some industrial waste products. Fluorides are used primarily in manufacturing and as a drinking water additive for the prevention of tooth decay. Fluoride occurs naturally in groundwater; however, the acceptability of water containing fluoride for domestic or municipal use depends on the concentration level.

Concentrations of fluoride in excess of the MCL have not been found in the Santa Cruz AMA. However, fluoride has been detected at concentrations below the MCL along the Nogales Wash.

7.5.4.9 Radiochemicals

Radioactive elements such as uranium, radon, and radium occur naturally in soil and water at locations throughout Arizona. The federally proposed primary MCL for radon is 300 picocuries per liter, but radon in groundwater is not regulated at this time. The EPA is currently collecting data on radon occurrences and conducting a health effects study prior to promulgating a radon standard for drinking water. Inhalation of radon may be harmful when it is released to the air from a contaminated water source. The primary concern of using radon-contaminated water is to ensure that the release of emissions are below air quality standards when processes such as cooling towers, construction aggregate washing, and sprinkler irrigation are used.

In the Santa Cruz AMA, naturally occurring contaminants such as radon affect groundwater in some areas which are generally located near hardrock formations.

7.5.5 Specific Contamination Areas

This section contains a description of the specific groundwater contamination areas which have been identified in the Santa Cruz AMA. Unless otherwise indicated, each of these sites are listed on the WQARF Priority List or the NPL. A summary of individual remedial sites in the Santa Cruz AMA are provided below. The status of each remedial site was obtained from the WQARF Quarterly Report submitted to the state Joint Legislative Budget Committee by the ADEQ for the period of July 1, 1997 through March 31, 1998.

- **Nogales United Musical Instruments Plant RCRA Site.** Located in northwest Nogales, this site exhibits groundwater contamination from TCE and dichloroethylene (1,1-DCE). Concentrations of 0.2-400 ug/l of TCE and 0.2-2500 ug/l of 1,1 DCE are present. This project is currently remediating the contaminated water utilizing aeration towers. The treated water is subsequently transported to a holding pond and the treated water is used to irrigate the Palo Duro golf course in Nogales.

- **Nogales Wash WQARF Site.** The Nogales Wash site encompasses the entire length of the wash from the international border to the confluence with the Santa Cruz River. Varying levels of contaminants have been detected in wells sampled along the wash. However, the extent of the various contaminations are not yet fully defined. This WQARF site includes one of the aquifers that serves as a source of water for several providers in the Santa Cruz AMA.

7.6 THIRD MANAGEMENT PLAN PROGRAM SUMMARY

Most groundwater supplies in the Santa Cruz AMA are of acceptable quality for most uses. However, human activity and natural processes have resulted in the degradation of groundwater quality in a few areas to the extent that it is unusable for many purposes. The extent and type of contamination varies by location and land use activities. In general, contaminated groundwater in the Santa Cruz AMA is caused by human activity. Concentrations of wells withdrawing water can influence the migration of poor quality water. While the UMI site is currently undergoing remediation, remedial investigations are still underway at the Nogales Wash site.

As WQARF activities progress, addressing water management issues such as available supply and reuse options will become essential to ensure a long-term water supply of adequate quality. The ability to recognize specific groundwater management requirements for contaminated and degraded aquifer conditions will also become increasingly important as the demand for water increases.

During the first and second management periods, ADEQ emphasized pump and treat remedies to cleanup poor quality groundwater. Success was limited, however, due to lengthy periods of litigation which have seriously restricted actual cleanup activities. With the advent of the WQARF reform package of 1997, a new approach emphasizing incentives to cleanup and flexibility in the selection of remedies was developed to improve the likelihood that sites will actually be remediated.

The 1997 WQARF reform legislation creates an incentive for the use of groundwater withdrawn in accordance with approved remedial action projects pursuant to Title 49, Arizona Revised Statutes, or CERCLA. It provides that such groundwater must be accounted for consistent with accounting procedures used for surface water and that the use of certain volumes of such groundwater is consistent with achievement of the management goals of the AMA until the year 2025. During the third management period, the Department will amend its AWS Rules to conform to these provisions. Additionally, permanent rules regarding general well spacing and impact will be promulgated by the Department during the third management period. The Department also intends to integrate water quality concerns more fully into its underground water storage programs.

During the third management period, the Department intends to enact and implement the provisions outlined in this chapter. This commitment will encompass the new provisions and activities summarized below:

- An on-going groundwater quality assessment in cooperation with ADEQ will assist with the evaluation of existing rules and provisions and provide better data to the public.

- Integration of groundwater quality management into recharge planning and permitting, and development of incentives to use remediated groundwater where appropriate.

- Formal permit coordination with ADEQ on both Title 45 and Title 49 permits. Basin-wide or non-site specific tracking and coordination of all permits will provide both agencies with a more complete picture of contaminant distribution, groundwater withdrawals, and releases to groundwater and surface water.

- Evaluation of the need for additional incentives to withdraw and remediate groundwater in an effort to match quality with beneficial use. This evaluation will include groundwater that may be contaminated with hazardous, non-hazardous, and naturally occurring substances. Incentives may involve amendments to Title 45, Arizona Revised Statutes, Department rules and policies, or a modification of the management plans.

- The Department and ADEQ will develop and enter into Memorandums of Understanding, as necessary, to establish, among other things, the division of responsibilities for the implementation of the reformed WQARF Program, development of common scopes of work for WQARF sites and other groundwater contamination sites, and database development and exchange.

The Department's Water Quality Section, which was established with funding provided by the 1997 WQARF reform legislation, will allow the Department to strengthen its commitment to work closely with ADEQ to resolve groundwater quantity and quality issues throughout Arizona.

Other remedial activities and management action plans such as those associated with Superfund sites will continue to include the Department's direct involvement. This will ensure that remedial activities meet the Department's water management objectives and are consistent with the AMA's goals.

7.7 FUTURE DIRECTIONS

The Department's long-range plans for groundwater quality management will focus on two areas: (1) evaluation of groundwater quality issues on a site and non-site specific level to understand the impact of broader groundwater quality issues on water resource management and (2) preservation of AMA management goals and interests while implementing incentives to use remediated groundwater.

7.7.1 Non-Site Specific Groundwater Quality Management

Non-site specific groundwater quality management refers to groundwater quality management activities which may occur in general areas located outside of an identified WQARF or CERCLA boundary. To address and mitigate dispersed contamination over large areas, a broader management strategy is needed. Areas which may need more intensive management can include those where public or private supply well have been or may be affected by contamination. For instance, areas that are in the vicinity of major population centers or agricultural areas can be affected by contaminants, especially if large volumes of water are withdrawn from wells, creating cones of depression.

The concept of groundwater quality management on a non-site specific scale will be developed to enhance water management activities in critical areas. The identification of source groundwater quality and the development of area-specific plans to match water quality with the intended use will become an important aspect in the third management period. The Department intends to study the development of area-specific plans that could employ a combination of strategies to evaluate and mitigate the effects of contamination in critical areas. These plans should be developed in coordination with ADEQ and with affected stakeholders. Any contaminant management on a non-site specific scale will be voluntary and will not affect rights to water, well ownership, delivery responsibilities, or existing permits.

7.7.2 Preservation of AMA Management Goals

The WQARF reform package of 1997 was designed to encourage the remediation of groundwater that has limited or no use due to contamination. Pump and treat groundwater remediation activities are anticipated to increase substantially during the third management period as a result of the remediated groundwater use incentives provided in the WQARF reform package. As a result, previously unavailable sources of groundwater from contaminated areas may be put to beneficial use.

Remediated groundwater withdrawals associated with WQARF, CERCLA, Department of Defense, RCRA, and voluntary site cleanups are expected to increase. Estimates of annual remediated groundwater withdrawals, provided by ADEQ and its contractors for existing remedial sites within the Santa Cruz AMA may be in the range of 3,000 acre-feet annually. This estimate is approximate and is subject to change based on future remedial activities. Additionally, the Nogales Wash site in the AMA is not represented in this estimate due to a lack of information. This estimate may be conservative because remedial activities are in different stages of development and additional sites may be identified in the future.

In the third management period, the Department will monitor water levels and effects on local water providers at remedial project sites in areas of intensive pumping. While the Department supports the remediation of contaminated groundwater, it also seeks to preserve the management goals of the Santa Cruz AMA. Water quality management is a lengthy process which is expected to continue far beyond the scope of the third management period. Continued remedial activities over the long-term will likely result in considerable volumes of groundwater being pumped, treated, and subsequently used.

The net effect of continued remediated groundwater withdrawals could result in an increase in the overall volume of groundwater used within the Santa Cruz AMA. Proper water quantity and water quality management will be required to ensure that groundwater use created as a result of remedial projects does not impact the goals of the Santa Cruz AMA. Remediated groundwater is not a renewable water supply and therefore must be managed as a diminishing resource. Consequently, the Department will seek to preserve the intent of the Code and the AMA management goals while cooperating with EPA, ADEQ, and other agencies to promote groundwater quality management.

APPENDIX 7A
DRINKING WATER STANDARDS AND HEALTH EFFECTS
SANTA CRUZ ACTIVE MANAGEMENT AREA
(Source: ADEQ Drinking Water Rules, April 28, 1995)

Contaminant	Primary MCL (mg/l)[1]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Inorganics			
Antimony	0.006	Cancer	Fire retardants, ceramics, electronics, fireworks, solder
Arsenic	0.05	Skin, nervous system toxicity	Natural deposits; smelters, glass, electronics waste
Asbestos	7.0 MFL[2]	Cancer	Natural deposits, asbestos cement in water systems
Barium	2.0	Circulatory system effects	Natural deposits, pigments, epoxy sealants, spent coal
Beryllium	0.004	Bone, lung damage	Electrical, aerospace, defense industries
Cadmium	0.005	Kidney effects	Galvanized pipe corrosion; natural deposits, batteries, paints
Chromium (total)	0.1	Liver, kidney, circulatory disorders	Natural deposits; mining, electroplating, pigments
Cyanide (as free cyanide)	0.2	Thyroid, nervous system damage	Electroplating, steel, plastics, mining, fertilizer
Fluoride[3]	4.0	Skeletal and dental fluorosis	Natural deposits; fertilizer, aluminum industries
Mercury	0.002	Kidney, nervous system disorders	Crop runoff; natural deposits; batteries, electrical switches
Nickel	Remanded	Gastrointestinal distress, skin irritation, respiratory congestion	Food, water, and metal alloys
Nitrate (as N)	10.0	Methemoglobulinemia	Animal waste, fertilizer, sewage, natural deposits, septic tanks
Nitrite (as N)	1.0	Methemoglobulinemia	Same as nitrate; rapidly converted to nitrate
Total nitrate/nitrite	10.0	Same as nitrate	Same as nitrate
Selenium	0.05	Liver Damage	Natural deposits; mining, smelting, coal/oil combustion
Thallium	0.002	Kidney, liver, brain, intestinal	Electronics, drugs, alloys, glass

APPENDIX 7A
DRINKING WATER STANDARDS AND HEALTH EFFECTS
SANTA CRUZ ACTIVE MANAGEMENT AREA
(Source: ADEQ Drinking Water Rules, April 28, 1995)

Contaminant	Primary MCL (mg/l)[1]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Volatile Organic Chemicals			
Benzene	0.005	Cancer	Some foods; gas, drugs, paint, pesticides, plastic industries
Carbon tetrachloride	0.005	Cancer	Solvents and degradation by-products
ortho-Dichlorobenzene	0.6	Liver, kidney, blood cell damage	Paints, dyes, engine cleaning compounds, chemical wastes
para-Dichlorobenzene	0.075	Cancer	Room and water deodorants, and mothballs
1,2-Dichloroethane	0.005	Cancer	Leaded gasoline, fumigants, paints
1,1-Dichloroethylene	0.007	Cancer	Plastics, dyes, perfumes, paints
cis-1,2-Dichloroethylene	0.07	Liver, kidney, nervous, circulatory	Waste industrial extraction solvents
trans-1,2-Dichloroethylene	0.1	Liver, kidney, nervous, circulatory	Waste industrial extraction solvents
Dichloromethane	0.005	Cancer	Paint stripper, metal degreaser, propellant, extraction
1,2-Dichloropropane	0.005	Liver, kidney effects; cancer	Soil fumigant; waste industrial solvents
Ethylbenzene	0.7	Liver, kidney, nervous system	Gasoline; insecticides; chemical manufacturing wastes
Monochlorobenzene	0.1	Nervous system and liver effects	Waste solvent from metal degreasing process
Styrene	0.1	Liver, nervous system damage	Plastics, rubber, resin, drug industries; landfill leachate
Tetrachloroethylene	0.005	Cancer	Improper disposal of dry cleaning and other solvents
Toluene	1.0	Liver, kidney, nervous, circulatory	Manufacturing and solvent operations, gasoline additive
1,2,4-Trichlorobenzene	0.07	Liver, kidney damage	Herbicide production, dye carrier
1,1,1-Trichloroethane	0.2	Liver, nervous system effects	Adhesives, aerosols, textiles, paints, inks, metal degreasers
1,1,2-Trichloroethane	0.005	Kidney, liver, nervous system	Solvent in rubber, other organic products; chemical production wastes
Trichloroethlylene	0.005	Cancer	Textiles, adhesives, and metal degreasers

APPENDIX 7A
DRINKING WATER STANDARDS AND HEALTH EFFECTS
SANTA CRUZ ACTIVE MANAGEMENT AREA
(Source: ADEQ Drinking Water Rules, April 28, 1995)

Contaminant	Primary MCL (mg/l)[1]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Vinyl chloride	0.002	Cancer	May leach from PVC pipe; formed by solvent breakdown
Xylenes (total)	10.0	Liver, kidney, nervous system	By-product of gasoline refining; paints, inks, detergents
Synthetic Organic Chemicals			
Alachlor	0.002	Cancer	Runoff from herbicides applied to crops
Atrazine	0.003	Mammary gland tumors	Runoff from herbicides used on crops and non-cropland
Benzo(a)pyrene	0.0002	Cancer	Fossil fuels, burning organic matter, coal tar coatings, volcanics
Carbofuran	0.04	Nervous, reproductive system effects	Soil fumigant; some area restrictions apply
Chlordane	0.002	Cancer	Leaching from soil treatment for termites
2,4-D	0.07	Liver and kidney damage	Runoff from herbicides applied to crops, rangelands, and lawns
Dalapon	0.2	Liver and kidney effects	Herbicide on orchards, crops, lawns, road/railways
Dibromochloropropane	0.0002	Cancer	soil fumigant
Di(2-ethylhexyl)adipate	0.4	Decreased body weight	Synthetic rubber, food packaging, cosmetics
Di(2-ethylhexyl)phthalate	0.006	Cancer	PVC and other plastics
Dinoseb	0.007	Thyroid, reproductive organ damage	Runoff of herbicide from crop and non-crop applications
Diquat	0.02	Liver, kidney, eye effects	Runoff of herbicide on land and aquatic weeds
Endothall	0.1	Liver, kidney, gastrointestinal	Herbicide on crops, land/aquatic weeds; rapidly degraded
Endrin	0.002	Liver, kidney, heart damage	Pesticide on insects, rodents, birds; restricted since 1980
Ethylene dibromide	0.00005	Cancer	Leaded gasoline additives; leaching of soil fumigant
Glyphosate	0.7	Liver, kidney damage	Herbicide on grasses, weeds, brush
Heptachlor	0.0004	Cancer	Leaching of insecticide for termites and very few crops
Heptachlor epoxide	0.0002	Cancer	Biodegradation of heptachlor

APPENDIX 7A
DRINKING WATER STANDARDS AND HEALTH EFFECTS
SANTA CRUZ ACTIVE MANAGEMENT AREA
(Source: ADEQ Drinking Water Rules, April 28, 1995)

Contaminant	Primary MCL (mg/l)[1]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Hexachlorobenzene	0.001	Cancer	Pesticide production waste by-product
Hexachlorocyclopentadiene	0.05	Kidney, stomach damage	Pesticide production intermediate
Lindane	0.0002	Liver, kidney, nervous, immune circulatory	Insecticide on cattle, lumber, gardens; restricted in 1983
Methoxychlor	0.04	Growth, liver, kidney, nerve effects	Insecticide for fruits, vegetables, alfalfa, livestock, pets
Oxamyl (Vydate)	0.2	Kidney damage	Insecticide on apples, potatoes, tomatoes
Pentachlorophenol	0.001	Cancer, liver and kidney effects	Wood preservatives, herbicide, cooling tower wastes
Picloram	0.5	Kidney, liver damage	Herbicide on grass sod, some crops, aquatic algae
Polychlorinated biphenyls	0.0005	Cancer	Coolant oils from electrical transformers; plasticizers
Simazine	0.004	Cancer	Herbicide on grass sod, some crops, aquatic algae
2,3,7,8-TCDD (Dioxin)	3×10^{-8}	Cancer	Chemical production by-product; impurity in herbicides
Toxaphene	0.003	Cancer	Insecticide on cattle, cotton, soybeans; canceled in 1982
2,4,5-TP (Silvex)	0.05	Liver and kidney damage	Herbicide on crops, rights-of-way, golf courses; canceled in 1983
Radionuclides			
Combined Radium-226 and Radium-228	5 pCi/l[4]	Bone Cancer	Natural deposits
Gross Alpha[5]	15 pCi/l	Cancer	Decay or radionuclides in natural deposits
Gross beta	4 mrem/yr[6]	Cancer	Decay of radionuclides in natural and man-made deposits
Radon-222 (Proposed)	300 pCi/l	Cancer	Natural sources
Uranium (Proposed)	20 µg/l[7]	Cancer	Natural sources
Microbiology			
Giardia lamblia	TT[8]	Gastroenteric disease	Human and animal fecal waste
Legionella	TT	Legionnaire's disease	Indigenous to natural waters; can grow in water heating systems

APPENDIX 7A
DRINKING WATER STANDARDS AND HEALTH EFFECTS
SANTA CRUZ ACTIVE MANAGEMENT AREA
(Source: ADEQ Drinking Water Rules, April 28, 1995)

Contaminant	Primary MCL (mg/l)[1]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Standard Plate Count	TT	Indicates water quality, effectiveness of treatment	
Total Coliform	9	Indicates gastroenteric pathogens	Human and animal fecal waste
Turbidity	9	Interferes with disinfection, filtration	Soil runoff
Viruses	TT	Gastroenteric disease	Human and animal fecal waste
Total Trihalomethanes	0.1	Cancer	Drinking water chlorination by-products

1 mg/l = milligrams per liter (all MCLs are in mg/l unless otherwise indicated)
2 "MFL" means million fibers per liter greater than 10 microns
3 The MCL for fluoride applies to community water systems only
4 pCi/l = picocuries per liter (30pCi/l is equivalent to 20 μg/l)
5 Gross particle activity, including Radium-226 but excluding Radon and Uranium
6 mrem/yr = millirem per year, see ADEQ, Drinking Water Rules source (1) for more information
7 μg/l = micrograms per liter
8 Treatment Technology (refer to source (1) for more information)
9 Refer to source (1) for more information

Sources:
1. Arizona Department of Environmental Quality, Arizona Drinking Water Rules, April 28, 1995
2. United States Environmental Protection Agency, Office of Water 4304, EPA 822-B-96-002, October 1996
3. United States Environmental Protection Agency, National Primary Drinking Water Regulations, Appendix A: National Primary Drinking Water Standards (Modified 1/14/98)

APPENDIX 7B
SECONDARY DRINKING WATER STANDARDS[1]
SANTA CRUZ ACTIVE MANAGEMENT AREA

Constituents	SMCLs (mg/l)[2]
Aluminum	0.05 to 0.2
Chloride	250
Color	15 color units
Copper	1.0
Corrosivity	non-corrosive
Fluoride	2.0
Foaming agents	0.5
Iron	0.3
Manganese	0.05
Odor	3 threshold odor numbers
pH	6.5 - 8.5
Silver	0.1
Sulfate	250
Total dissolved solids	500
Zinc	5

[1] Secondary Drinking Water Standards are unenforceable federal guidelines regarding taste, odor, color and certain other non-aesthetic effects of drinking water. States may adopt their own enforceable regulations governing these concerns.
[2] Secondary Maximum Contaminant Levels (SMCLs) units are in milligrams per liter (mg/l) unless otherwise indicated.

Source:
United States Environmental Protection Agency, Office of Water 4304, EPA 822-B-96-002, October 1996.

APPENDIX 7C
POSSIBLE WATER QUALITY REMEDIES
SANTA CRUZ ACTIVE MANAGEMENT AREA

The bullets below describe various remedies that are available to address sites of contaminated groundwater.

- **Plume Remediation**

Plume remediation or aquifer restoration means achieving appropriate water quality standards for groundwater throughout the affected area. Source control and monitoring will likely be essential elements of this strategy. This remedy may be more effective for smaller plumes which can be remedied within reasonable time frames.

- **Physical Containment**

Physical containment refers to an approach that contains contaminants within defined boundaries. This strategy could consist of plume control and coordination of groundwater pumpage and recharge to ensure that contamination is confined within a defined area. Source control and monitoring are also likely elements of this strategy. Physical containment may be appropriate in cases where potable water supplies are threatened by contaminant migration and where containment is technically feasible, but it may require extensive groundwater management to implement.

- **Controlled Migration**

This strategy aims to control but not necessarily contain contaminant migration. Source control and monitoring are likely elements of this strategy. Control of contaminants can include control and/or coordination of pumpage that affects contaminant migration and any other measures taken to control contaminant migration. Controlled migration may be appropriate for larger plumes which cannot be practically remedied or contained.

- **Source Control**

Source control is a reduction of continuing contaminant sources such as soil contamination or areas of high concentrations of VOCs or other contaminants. Dense non-aqueous phase liquids (DNAPLs), which are contaminants (such as VOCs) of such high concentrations that they are not dissolved in groundwater but exist as free phase liquids, are an example of contaminant sources. Source control is a remedial action that often results in the highest volume of contaminants removed per unit cost.

This strategy employs controlling the pollutant at the source to ensure that aquifer contamination does not migrate due to uncontrolled contaminant releases. Monitoring is a likely component of this strategy. Source control can include, but is not limited to, the remediation of sorbed or free phase contaminants, pumpage of groundwater to contain or control significant sources of contaminants, and the removal of contributing contaminant sources.

- **Monitoring**

Monitoring water quality conditions, instead of implementing actual cleanup activities, can be a remedy applied to sites with low risk to human health or the environment. Monitoring sites is also an important part of many remediation plans to assess the extent of contamination and the effectiveness of remedial activities. Computer groundwater models may be used to predict contaminant movement, to monitor well locations, and to develop contingency plans for more aggressive remedies, if necessary.

APPENDIX 7C *(continued)*
POSSIBLE WATER QUALITY REMEDIES
SANTA CRUZ ACTIVE MANAGEMENT AREA

- **No Action**

This alternative consists of taking no action at a site. The site is not monitored nor are any remedial actions performed. This strategy is normally included as a baseline condition for comparison purposes in a remedial investigation feasibility study, but may be a viable alternative in limited cases. Generally, this alternative would only be chosen for sites that are geographically isolated from populated areas, do not pose a significant threat to drinking water supplies, or would be used for comparative purposes to other sites.

CHAPTER

8

Augmentation and Recharge Program

8.1 INTRODUCTION

The goal of the Third Management Plan Augmentation Program is to promote water supply and distribution efforts which (1) maintain existing water resources to sustain current demands; (2) secure renewable water supplies for the purpose of maintaining safe-yield conditions, meeting committed demands, and supplying future needs; and (3) prevent long-term declines and stabilize local water tables in areas of concern. Chapters 2, 3, and 11 highlight the importance of effluent as a renewable supply in meeting the current demands and projected growth within the Santa Cruz Active Management Area (AMA). Operated by the International Boundary and Water Commission (IBWC), the Nogales International Wastewater Treatment Plant (NIWWTP) discharges large volumes of treated effluent into the Santa Cruz River. This effluent is a very important component contributing to the stability of local water levels in downstream segments of the Santa Cruz River. Consequently, effluent contributes significantly to the achievement of the management goals in the Santa Cruz AMA. Other sources of renewable supply might include Peña Blanca Lake, Patagonia Lake, effluent from other locations, and water from previously unexplored tributaries and washes. Traditionally, augmentation programs are geared to the gradual replacement of groundwater with renewable water supplies to meet regulated demands. The unique mixture of effluent, surface water, and groundwater supplies in the Younger Alluvium of the Santa Cruz River, the reliance of water users in the Santa Cruz AMA on effluent to recharge the younger alluvial aquifer, and the existence of smaller aquifers with limited storage capacity, separate the Santa Cruz AMA from other AMAs in the approach necessary to develop an augmentation program for the Third Management Plan.

Several outstanding issues must be addressed before an effective augmentation program can be fully developed for the Santa Cruz AMA. Ultimately, the challenge for water planners in the Santa Cruz AMA will be to secure additional water supplies and/or provide for the discontinuation of some current demands to allow for continued growth while continuing to meet AMA goals. In order to implement an augmentation and recharge program for the Santa Cruz AMA, the various water users need to work together to: (1) determine how to best utilize currently available renewable supplies; (2) determine how to develop effective recharge projects, given hydrologic conditions; (3) determine where additional water supplies may be obtained; (4) explore the option of creating a water district; and (5) determine what functions such a district could perform. All of these tasks will need to be considered within the context of local community preferences and legal, economic, political, and environmental conditions. Most of these tasks will necessitate additional data collection and analysis.

While the principal responsibility for developing water supplies remains with the region's water users, the Arizona Department of Water Resources (Department) has an important role in facilitating the development and maximum use of these supplies. The current scope of the Department's activities in augmentation and recharge includes the following:

- Data management and public information. The Department's responsibility for accumulation and dissemination of water use and water supply data provides the information necessary to develop water management plans, implement augmentation projects, conduct research related to increasing available water supplies, and identify geographic areas requiring additional water management.

- Technical and planning assistance. The Department provides technical assistance by reviewing and providing input on proposals for water augmentation and recharge projects, planning and feasibility studies, project operations, and data interpretation.

- Coordination and facilitation. The coordination and facilitation of augmentation and recharge activities, particularly between jurisdictions and multiple regulatory agencies, is an important component of the Department's statewide and regional water planning responsibilities.

- <u>Financial assistance</u>. The augmentation and conservation assistance fund, as well as specifically budgeted appropriations, provides financial assistance to entities implementing augmentation projects or studies that contribute to achieving the AMA water management goal or resolving regional water management issues.

- <u>Statutory roles</u>. The director is statutorily designated as the representative of the State of Arizona in Colorado River and interstate water issues; advisor to the Secretary of the Interior in allocating water among users; coordinator of Arizona's review and comments on water development proposals by the United States Army Corps of Engineers, Secretary of the Interior, and Secretary of Agriculture; and manager of the state's water rights to ensure achievement of water management objectives.

- <u>Regulatory and permitting authority</u>. The Department's regulatory and permitting authority regarding use of water rights and development of recharge projects ensures that these uses of water achieve water management objectives.

- <u>Regulatory incentives</u>. Regulatory incentives are established in the agricultural, municipal, and industrial conservation programs (chapters 4, 5, and 6, respectively). These incentives are intended to facilitate the implementation of augmentation activities by water users. The groundwater quality management program (Chapter 7) identifies methods to increase available water supplies by increasing the use of poor quality water.

Because the Augmentation and Recharge Program included in the Second Management Plan was geared to the water management goal and supply options existing in the Tucson AMA, an entirely new program designed for the water management goal of the Santa Cruz AMA must be developed. During the third management period, data collection and research efforts will continue and be expanded to help in meeting augmentation and recharge objectives for the Santa Cruz AMA. Additional routine data collection and site specific studies, the completion of the Department's hydrologic model, the potential outcome of the proposed water rights settlement interim decree for the Santa Cruz AMA, the result of the facilities planning process between the United States and Mexico, the possibility of the creation of a water district, and the development and adoption of Assured Water Supply consistency with management goal criteria for the Santa Cruz AMA could further clarify the needs and priorities for the Augmentation and Recharge Program for the Third Management Plan.

The following topics are discussed in the order listed:

- AMA Assessment
- Second Management Plan Augmentation Program
- Program Development Issues
- Program Goals and Objectives
- Third Management Plan Augmentation and Recharge Program
- Future Directions
- Conclusions

8.2 <u>ASSESSMENT OF SANTA CRUZ ACTIVE MANAGEMENT AREA</u>

As previously noted, there are a number of issues specific to the Santa Cruz AMA which require closer examination to determine the potential effectiveness of an augmentation program. An assessment of the statutory issues, binational considerations, modeling efforts and information gathering, and developing water rights decree and potential district legislation is designed to introduce the reader to the full spectrum of variables which must be addressed in order to effectively implement an augmentation program for the Santa Cruz AMA.

8.2.1 Statutory Issues

The hydrology of the Santa Cruz AMA, the international issues which affect the AMA's water management, and the unique management goals for the AMA present numerous complex issues which may affect an augmentation program for the AMA. These issues will need further exploration and analysis as the water management program for the Santa Cruz AMA is refined. A few of the more immediate issues are briefly presented in the following sections.

8.2.1.1 Coordinated Water Management

When the Santa Cruz AMA was created, the legislature recognized that the hydrology of the Santa Cruz AMA required a water management program that coordinates the management of both groundwater and surface water. Thus, a number of water management programs in the Groundwater Code (Code) for the Santa Cruz AMA make reference to "water, other than stored water, withdrawn from a well," instead of simply "groundwater."

In spite of this effort at coordinated water management, it remains true that many legal characteristics of water in Arizona depend upon whether the water is classified as surface water or groundwater. The issue, however, of how to distinguish between groundwater and surface water is still being considered by the Arizona Supreme Court. This lack of certainty makes water management and development and implementation of an augmentation program particularly difficult in the Santa Cruz AMA where there is a close hydrological connection between surface flows and groundwater.

These issues are further complicated by the significant amounts of effluent that are released into the Santa Cruz River from the NIWWTP. As most fully described in *Arizona Public Service Company v. Long*, 160 Ariz. 429, 773 P.2d 988 (1989), effluent has legal characteristics that are different from surface water and groundwater.

Answering the question of which set of legal characteristics apply to what water in the Santa Cruz AMA will not be easy but is essential if a solid and long-lasting augmentation program is to be developed for the AMA.

8.2.1.2 Recharge Issues

In the other AMAs, recharge is a significant tool for water augmentation. Currently, however, there are no recharge projects in the Santa Cruz AMA. Central Arizona Project (CAP) water, which is the primary source of recharged water in other AMAs, is not available in the Santa Cruz AMA. Significant effluent is available, but that effluent is currently released into the Santa Cruz River where it helps maintain the level of local water tables. Effluent could be used for recharge within the AMA, but a number of issues could make obtaining the necessary permits and credits challenging.

Designating a stretch of the Santa Cruz River as a managed underground storage facility has been discussed for a number of years and would allow discharges of effluent into the river to continue but would allow entities with rights to the effluent from the NIWWTP to accrue storage credits to withdraw water at a later time. Managed underground storage facility permits in other AMA's, however, have resulted in protests from persons owning parts of the streambed over which the facility is located claiming trespass and by downstream appropriators who claim that the effluent, when released to the streambed, becomes appropriable water, notwithstanding the issuance of the managed underground storage facility permit. These issues are still being litigated.

There may also be hydrologic issues in attempting to recharge water into a relatively shallow basin. In addition, the distinction between effluent and natural flows would need to be accounted for in any managed recharge facility, as would any of the "stored" effluent that eventually leaves and is not available for use in the AMA.

8.2.2 Binational Considerations

8.2.2.1 Mexican Rights to Effluent

Effluent from the NIWWTP is an important source of renewable water which could be used for demonstrating an assured water supply for future growth in the Santa Cruz AMA. Effluent discharge also plays a major role in maintaining water tables and riparian habitat in the Younger Alluvium downstream from the NIWWTP. A balance between the use of effluent discharge to meet future demands and the current use of effluent by riparian areas, along with the maintenance of local water table levels is an important objective.

The absence of a formal agreement to assure the long-term availability of wastewater inflow from Mexico compounds the dilemma of whether or not effluent would be available in significant quantities for future recharge projects in the Santa Cruz AMA. Mexico currently has a legal right through treaty agreement to claim their portion of effluent treated at the NIWWTP, which is currently about two-thirds of the effluent produced. Of the NIWWTP's design capacity of 17.2 million gallons per day (mgd), 9.9 mgd of treatment capacity is allocated to Nogales, Sonora and the remaining 7.3 mgd is allocated to Nogales, Arizona.

The international treaty between the United States and Mexico states that the inflow of the wastewater originating from Sonora could be retained or reduced by Mexico at any time. The treaty also states that Mexico may recover and transport its effluent back across the International Boundary at anytime. This clause creates uncertainty for the continuity of current levels of effluent discharge to maintain the present water table. Mexico is also currently planning to construct a wastewater treatment facility south of Nogales, Sonora. It is likely that Mexico will maintain the current flow of wastewater to the NIWWTP and treat additional wastewater at the new facility, recharging the effluent from the new facility in the Los Alisos subbasin. In Chapter 11, the Department has included an assumption that such a facility would be constructed and become operational by the year 2005.

8.2.2.2 Impacts of Mexican Water Augmentation Plans

Nogales, Sonora's water shortage has led to the development of a water supply plan to meet the shortfall and prepare for the continued rapid rate of growth. The water supply plan contains components addressing both potable supplies and wastewater management.

8.2.2.2.1 Wastewater Plan

The first phase of the plan will include wastewater system improvements which do not directly affect the availability of water resources in Arizona. The proposed Nogales Infrastructure Project is projected to be submitted to the Border Environment Cooperation Commission (BECC) in 2000 for certification, and subsequently to the North American Development Bank (NADBank) for funding.

Several wastewater plan alternatives were prepared and examined. Ultimately, Alternative 6 was selected by both United States and Mexican representatives to address the wastewater needs in *ambos* (both the Arizona and Sonoran portions of) Nogales. In order to minimize costs, the project will be implemented in phases, with segments constructed as needed and allowing for future expansion.

Alternative 6 consists of:

a) upgrade and expansion of the NIWWTP
b) rehabilitation and expansion of the international outfall interceptor (IOI), which is presently a bottle neck for wastewater crossing the border
c) construction of a wastewater treatment plant in Los Alisos
d) construction of pump stations to convey sewage to the Los Alisos plant
e) rehabilitation of the wastewater collection systems in Arizona and Sonora

Construction phasing of the project would go along the following lines, although the present certification from the BECC would apply to the first phase only:

Phase I	Upgrade and expansion of the NIWWTP (to reduce the ammonia in the Santa Cruz River); rehabilitation and expansion of the IOI (reduce leaks and the possible aquifer contamination from those leaks); and rehabilitation of collection systems in both Nogales, Arizona and Nogales, Sonora. Construction of a 5-7 mgd wastewater treatment plant in Los Alisos, as well as construction of the interceptor and possibly a pump station.
Phase II	Expansion of the Los Alisos wastewater plant, construction of a collection system south of the divide, and, if necessary, construction of additional pump stations.

The United States Environmental Protection Agency (EPA) is proposing to approve a funding scheme which would use a combination of Border Environment Infrastructure Fund (BEIF) money from NADBank, combined with local contributions, to fund these projects.

8.2.2.2.2 Potable Supply Plan

Previous discussions on developing additional potable water supplies have not clarified whether Nogales, Sonora would increase its withdrawals from the Santa Cruz River. However, if the current rate of development continues, it is almost certain that additional supplies will be required and the Santa Cruz River is the closest source of additional supply.

Surface water flow along the Santa Cruz River is extremely variable from year to year. The volume of flow ranges from just a few thousand acre-feet per year to more than 80,000 acre-feet per year. Increased withdrawals along the Santa Cruz River in Sonora, coupled with the high variability in the natural supply, may result in the following negative consequences for the Santa Cruz AMA:

- The Nogales, Arizona municipal wellfield at the State Route 82 microbasin, which is located downstream of the proposed extraction site, would be more susceptible to reduced surface flow and drought resulting in the need to firm this supply if it is to be used as a future source. Firming a supply involves the acquisition of additional or alternative supplies to be used during those times when the primary supply is not sufficient to meet demands.

- Riparian habitat along the Santa Cruz River might be damaged (particularly near the international border).

- The ability to accommodate committed demands in the southern portion of the Santa Cruz AMA might be decreased.

8.2.3 Hydrologic Modeling Efforts and Information Gathering

The complex hydrology of the river sometimes makes it difficult to define the relationship between pumpage and recharge. The Department has prepared a hydrologic model of the Santa Cruz River basin and is currently calibrating the model. In the future, it is hoped the model will assist in better defining water availability and developing water management programs.

After the hydrologic model for the Santa Cruz River basin is completed, it is expected to provide information that will allow an estimate of the minimum flow necessary to maintain the AMA goals. The hydrologic model incorporates the most comprehensive database prepared for the Santa Cruz River watershed to date, including information that has been graciously provided by the Mexican National Water Commission through a data exchange. Since no other more extensive hydrologic or habitat studies for this area exist, there is insufficient information currently available to precisely determine minimum discharge requirements from the NIWWTP in order to maintain the local water table levels in the effluent dominated reach of the Santa Cruz River.

The Department intends to utilize funding from the Water Management Assistance Program (see Chapter 9) and matching funds from other sources to improve knowledge of the hydrology in the AMA.

8.2.4 Potential Impacts on Local Water Table Levels

Safe-yield conditions may be difficult to maintain as committed demand is included in the annual balance of demands and supplies. Typically, committed demand is considered to be platted lots to which water service has not yet begun. Moreover, there are a number of locations within the AMA where continued or increased pumpage could cause severe water table level declines.

8.2.4.1 Development in the Northern Portion of the AMA

Significant future development is anticipated to occur in the northern portion of the Santa Cruz AMA from Amado to Tubac. Residential development is encroaching southward from Green Valley. Since most agricultural and industrial water users in this area have not used their full water allocations for many years, it is likely that overall water use in the area will increase substantially. Increased pumpage could draw down water levels near Amado.

If new subdivisions built around Tubac and Amado continue the trend of installing septic systems instead of centralized wastewater collection systems, an important renewable water supply will be lost and the potential for water quality problems will increase. Given the likelihood of expanding residential development, it is important that all water supplies, including wastewater locally generated from new subdivisions, be efficiently used. The future of effluent discharge, which could significantly impact the availability of water to consumers in the northern AMA, is a concern. A proliferation of septic tank systems rather than a centralized sewer system could also result in increased nitrate levels in wells in the same general area.

Development which expands along the Sopori Wash corridor also faces the possibility of reduced water levels. Although water levels have risen 10-20 feet in the immediate area between 1982 and 1995 due to a reduction in agricultural demand, new residential development occurring along Sopori Wash may result in water level declines in the immediate vicinity; and, if the demand is great enough, potentially prevent some of the tributary flow from reaching the Santa Cruz River, which may have further impacts on waters users in Amado.

8.2.4.2 Water Limitations In the Microbasin Area

The area upstream from the NIWWTP is also referred to as the "microbasin" area. The microbasins are a series of interconnected, descending mini-aquifers, or basins which are characterized by their limited water storage capacity. The average depth is only 75-150 feet deep, although one of the basins is estimated to be nearly 300 feet in depth. Water levels in this area respond quickly to both flooding and drought as described in Chapter 2.

Prolonged periods of drought aggravate the problem of limited storage capacity in the microbasin area. The City of Nogales maintains a municipal wellfield in this location and must alternate its pumping regime between this wellfield and its Potrero Creek wellfield during dry seasons to ensure the delivery of potable water to its customers.

A continuation of dry years would severely impact the stability of local water levels in this area, particularly if municipal and industrial water demands continue to increase. Even extreme short-term drought events may result in severe water shortages for water users in the area. Limited storage capacity further impedes the ability of the microbasin reach to build a reserve of water in the event of future droughts.

8.2.4.3 Potrero Creek Area

Potrero Creek is located northwest of the City of Nogales, upstream from the NIWWTP. Potrero Creek and the Highway 82 wellfield, which located in the microbasin area, are the two primary sources of water supply for the City of Nogales. Potrero Creek is a relatively deep aquifer system, with a documented cone of depression around the City's wells. A shallower, upper aquifer also appears to exist in Potrero Creek. The shallow aquifer, which supplies the flow of Potrero Creek during wet cycles and also feeds a wetland, is perched over a semi-permeable soil lens layer. The lower aquifer appears to be a traditional basin-fill aquifer, and has more capacity for storage than the City's microbasin wellfield. Water level declines between 1982 and 1995 were in excess of 20 feet at Potrero Creek. Additional pumping at this location could result in additional water level declines. More information is in the process of being collected to provide a better understanding of the extent of both the upper and lower aquifers in the Potrero Creek area.

8.2.5 Availability and Use of Renewable Supplies

Due to the relatively limited storage capacity and extreme variability in annual net natural recharge in the Santa Cruz AMA, new residential or commercial growth will require firm back-up supplies to maintain AMA goals.

8.2.5.1 Effluent

8.2.5.1.1 Availability

Roughly two-thirds of NIWWTP influent (untreated wastewater) originates from Nogales, Sonora and is transported into the United States through a pipeline underneath Nogales Wash which terminates at the NIWWTP. Table 8-1 provides a recent summary of the volume of annual influent received by the NIWWTP separated into United States and Mexican components. After treatment, the effluent has historically been discharged into the Santa Cruz River. Since the plant began operation in the 1960s, water levels have risen in the local water table downstream.

8.2.5.1.2 Legal Ownership

Based on the legal decision rendered in *Arizona Public Service Company v. Long*, 160 Ariz. 429, 773 P 2d 988 (1989), effluent abandoned into a natural channel becomes appropriable surface water. However, the entity abandoning the effluent into the stream has no obligation to continue doing so. Three entities have the right to use NIWWTP effluent prior to discharge: Nogales, Arizona; Mexico; and to a lesser degree, Rio Rico Utilities. Mexico owns two-thirds of the effluent presently generated at the NIWWTP and is allowed to recapture this water and transport it to Mexico for use there. If either Mexico or the City of Nogales diverts their portion of effluent prior to its discharge from the plant, the effluent-dominated flow available for appropriation by downstream water users would be reduced.

8.2.5.1.3 Direct Use

Effluent has not historically been used within the Santa Cruz AMA to any significant extent. However, effluent is an ideal source of supply for use by turf-related facilities due to its nutrient-rich quality. Using effluent directly means that water remains in the local aquifer that otherwise would have been withdrawn. This would be very beneficial to local water table management in areas upstream of the NIWWTP. Of the four turf-related facilities in the Santa Cruz AMA (described in Chapter 6), the Rio Rico golf course is the closest facility to the NIWWTP and is located downstream. However, the Palo Duro golf course may use effluent sooner than any other facility due to the assured water supply needs of the City of Nogales. One of these two turf-related facilities is most-likely of the four turf-related facilities to begin using effluent from the plant for turf-related watering in the future. The Tubac Country Club constructed a greywater wetlands to provide effluent for golf course irrigation. Effluent can also be used for the irrigation of certain crops, such as forage crops for cattle.

To encourage the use of effluent on turf-related facilities, the Department has increased the effluent incentive offered in the Second Management Plan. For the third management period, a facility may qualify for the effluent incentive with a smaller percentage of use that is effluent, and the use of effluent will be counted at a rate reduced from the Second Management Plan rate when determining compliance. This means that a facility can use more effluent than it could before and still remain in compliance with its conservation requirement if other sources of water are also used. Any facility that uses 100 percent effluent is not subject to the conservation requirements, just as in the Second Management Plan.

TABLE 8-1
ANNUAL SEWAGE INFLUENT AT THE NIWWTP: 1990-1998
IN ACRE-FEET
SANTA CRUZ ACTIVE MANAGEMENT AREA

Source of Effluent	1990	1991	1992	1993	1994	1995	1996	1997	1998
United States	4,448	5,355	5,194	5,442	5,170	5,514	4,494	4,677	5,617
Mexico	6,089	8,092	9,545	10,023	9,890	11,208	9,806	9,529	10,648
Total	10,537	13,447	14,740	15,465	15,060	16,721	14,301	14,206	16,265

* Derived from annual wastewater flow records compiled by the IBWC

Although the Department encourages the direct use of effluent, there are some obstacles to using effluent directly in the Santa Cruz AMA. First, effluent discharged from the NIWWTP that is abandoned into the Santa Cruz River becomes appropriable as surface water for downstream water users. It is unclear what impacts there would be on downstream users who have already appropriated the effluent if one of the three entities entitled to it reclaims the effluent before it leaves the plant. Second, there is significant cost associated with the construction of distribution lines dedicated to the transportation of effluent. According to Arizona Department of Environmental Quality (ADEQ) rules, effluent cannot be distributed using a potable system. A substantial demand for the effluent would be necessary before an entity would construct a distribution system dedicated to the transportation of effluent. Third, there are not a large number of demands in the Santa Cruz AMA which are eligible under ADEQ rules to receive and use effluent. Effluent may be used to water turf and irrigate crops, under certain circumstances.

8.2.5.1.4 Recharge and Recovery

Recharge allows effluent to be stored during low demand periods and later recovered during high demand periods. Recharge also allows the possibility of indirect potable use of effluent. The City of Nogales has explored the possibility of obtaining an Underground Storage Facility Permit for either a constructed or managed effluent recharge facility in the vicinity of the NIWWTP and Guevavi Ranch. However, any recharge activities in the Santa Cruz AMA must take into account the unique hydrologic conditions and the statutory and binational considerations previously described in this chapter.

8.2.5.2 Central Arizona Project Water

Since the Second Management Plan was promulgated, it has become clear that the utilization of CAP water is not currently economically feasible in the Santa Cruz AMA. The distance from the aqueduct and increase in elevation from the CAP terminus near Green Valley to water users in the Santa Cruz AMA make the costs in bringing in this supply prohibitive. Recognizing this, the City of Nogales and Rio Rico Utilities recently transferred their CAP allocations and have committed the proceeds to developing other water supplies.

8.2.5.3 Other Surface Water Sources

8.2.5.3.1 Patagonia Lake

Patagonia Lake is located northeast of Nogales and is supplied by the perennial flow from Sonoita Creek. The lake is part of Patagonia State Park and Arizona State Parks holds the storage right and water right for 11,420 acre-feet for recreation and wildlife uses. The City of Nogales has a permit to appropriate 4,200 acre-feet of water from Patagonia Lake for municipal purposes. The permit was issued in 1975 but has never been perfected. In the case of an emergency, A.R.S. § 41-511.20 provides that if the mayor of Nogales and the director determine that there is not sufficient water for use by the city and there is no other water available from any other practical source, the Arizona State Parks Board must authorize the city to remove from the lake the amount of water as needed to supply the city with sufficient water. However, to obtain the water, the City of Nogales must provide the means for transferring the water. The City of Nogales has never constructed the works necessary to transport and deliver water from the lake to the city. Nevertheless, Patagonia Lake is a perennial source of supply and could meet at least the current water demands for the City of Nogales if the city were able to construct the works necessary to deliver the water and obtain a water right to use water from the lake, subject to the rights of senior appropriators.

8.2.5.3.2 Peña Blanca Lake

Peña Blanca Lake is owned by the United States Forest Service (USFS) and the Arizona Game and Fish Department. The lake is located northwest of the City of Nogales and is southwest of Rio Rico. The lake supplies the needs of the USFS and serves as a preserve for wildlife in the Coronado National Forest. The lake is also a popular local recreation destination. Using Peña Blanca Lake as a source of supply could prove to be difficult. There are several limiting physical and legal barriers to overcome in order to utilize this renewable resource.

First, there is the legal barrier of obtaining an allocation from the USFS and Arizona Game and Fish since the lake is a supply source for the wildlife of the Coronado National Forest. Negotiations with both parties would be needed in order to obtain an allotment. The allotment could be limited depending upon commitments for wildlife and recreational uses.

The second barrier is related to topography. A pipeline would have to be constructed to bring water through the mountains to water users on the other side. The construction costs of booster stations and pipeline, as well as the operation and maintenance costs, could make this project prohibitive for the City of Nogales. However, the natural channel through Agua Fria Canyon could be used as the conduit to supply Rio Rico, which is down gradient from the lake.

Finally, there may be a water quality concern associated with the use of this source of supply. Mercury has been detected in the flesh of some of the fish in the lake. Because this metal has not been detected to date in the water of the lake, it may be located in the lake sediments.

8.2.5.3.3 Runoff Retention

Another potential source of supply that requires further study is the potential to slow storm water runoff and retain seasonal flow in the Santa Cruz River and its tributaries so that the maximum potential recharge can occur.

8.2.5.4 New Groundwater Sources

There has been very little information collected to date on the Older Alluvium of the Santa Cruz AMA because there has been little demand in this area so far. Gathering additional information on the Older Alluvium may reveal new locations where water is stored and areas where recharge could effectively occur, even though it is generally thought that the Older Alluvium is a low-yielding aquifer.

The Nogales Wash aquifer, which overlays the Nogales Formation and older alluvium, is virtually an untapped source of supply. Although water withdrawn from existing well depths meets potable water quality standards, there have been several instances where volatile organic compounds (VOCs) have been detected in excess of federally established maximum contaminant levels (MCLs). The wells where VOC samples exceeded the MCLs are still permitted to be operated, however, since these detections have occurred in isolated instances and have not been detected consistently. It is unknown whether persistent occurrence of VOCs in samples above the MCLs will occur in the future.

8.3 SECOND MANAGEMENT PLAN AUGMENTATION PROGRAM

This section summarizes the Second Management Plan augmentation program for the Tucson AMA and evaluates its applicability to Santa Cruz AMA water supply issues. The Santa Cruz AMA was part of the Tucson AMA at the time the Second Management Plan was adopted. Augmentation efforts in the Santa Cruz AMA have been late to develop and limited in scope since the AMA was created in 1994.

8.3.1 Program Overview

The Code required the Department to include a water supply augmentation program in the Tucson AMA's First Management Plan, although augmentation activities during this period were not conducted in the area that would become the Santa Cruz AMA. For the Second Management Plan, the Code required the inclusion of incentives for artificial groundwater recharge for each AMA. (A.R.S. § 45-565(A)(6)) The Code defines augmentation as supplementing the water supply of an AMA, including the importation of water into the AMA, water storage, and artificial groundwater recharge. (A.R.S. § 45-561.2)

The augmentation program in the Tucson AMA during the second management period (1990-2000) was designed to increase the use of renewable water supplies in order to reduce the overall dependence on groundwater withdrawals to meet water demands. The program encouraged the use of CAP water and effluent in order to preserve groundwater for future uses in the AMA. To maximize use of these water supplies, the program included provisions to incorporate groundwater recharge into plans for water supply development.

The Second Management Plan stated that during the second management period, the Department would take a lead role in identifying, facilitating, and coordinating augmentation activities. The Department would also provide planning support, technical support, and financial assistance to entities wishing to implement augmentation projects in the Tucson AMA during the second management period.

The Second Management Plan augmentation program included five main elements designed to assist water users in developing new water supplies: (1) regulatory incentives, (2) technical assistance, (3) coordination and facilitation of efforts, (4) resolving legal and institutional barriers, and (5) the augmentation and conservation assistance fund. The Second Management Plan provided incentives for water users to implement augmentation measures, especially for the use of effluent. Methods to increase the water supply available by increasing the use of poor quality water were also included in the Second Management Plan.

During the second management period, the Department facilitated technical efforts between the United States Department of the Interior, the City of Nogales, and Rio Rico Properties to coordinate the CAP importation study. Because the study found that bringing CAP water to the Santa Cruz AMA was not economically feasible, the City of Nogales and Rio Rico Properties transferred their CAP allocations in 1992 to the City of Scottsdale. The Department also initiated discussions in conjunction with federal, state, and Mexican organizations to coordinate and facilitate augmentation activities in the Santa Cruz AMA.

8.3.2 Assured and Adequate Water Supply Rules

In February 1995, the Department adopted new rules for its Assured and Adequate Water Supply Program. The Assured Water Supply Program (AWS Program) applies to new subdivisions within AMAs, and the adequate water supply program applies to new subdivisions outside of AMAs. The Assured Water Supply Rules (AWS Rules) are intended to aid in achieving AMA water management goals and to ensure sufficient water supplies for new development.

To encourage earlier use of CAP water, legislation in 1994 changed the statutory expiration date from December 31, 2001 to December 31, 1997 for those cities and towns deemed to have an assured water supply simply because they hold CAP subcontracts.

8.3.3 Groundwater Transportation Act

Passage of the 1991 Groundwater Transportation Act severely restricted the ability of municipal water providers to transfer groundwater out of rural basins into AMAs. The act nonetheless provided a legal framework for interbasin transfers of groundwater supplies to assist in demonstrating an assured water supply. The act was amended in 1995 to prohibit groundwater transfers between rural basins.

8.3.4 Water Exchange Act

Passage of the 1992 Water Exchange Act allowed for the trade between water users of any water supplies for any other water supplies as long as each water user has the legal right to use the water it gives in trade.

8.3.5 Central Arizona Groundwater Replenishment District and Santa Cruz Valley Water District

In 1993, legislation was passed that created the Central Arizona Groundwater Replenishment District (CAGRD) in the Phoenix, Pinal, and Tucson AMAs. Administered by Central Arizona Water Conservation District (CAWCD), the purpose of the district is to utilize excess CAP water and other renewable water supplies to replenish aquifers when groundwater is withdrawn by CAGRD members in excess of their groundwater allocations under the AWS Rules. Membership in the CAGRD was made voluntary.

There is no replenishment district in the Santa Cruz AMA; however, a water district or other entity that may be formed in the AMA could be given the authority to replenish water on behalf of the AMA water users. Statutory language which created the Santa Cruz Valley Water District still exists, although the district is not functional. This language, found in A.R.S. §§ 48-4801 through 48-4984, could be reexamined to determine if a portion of it could be used to develop a water district in the Santa Cruz AMA.

The creation of a water district or other entity in the Santa Cruz AMA could assist the Department in its augmentation efforts by seeking to efficiently distribute current supplies, obtain additional water supplies, perform studies to identify potential recharge sites, and potentially to assist in water rights marketing negotiations. If a water district is created, there would be an opportunity in the future for Mexico to participate in the district and perhaps take part in some type of water exchange involving effluent recharged upstream from the Nogales, Sonora Santa Cruz River wellfield.

8.3.6 Underground Water Storage, Savings, and Replenishment Program

Passage in 1994 of the Underground Water Storage, Savings, and Replenishment Program included all of the various recharge programs authorized since passage of the 1986 Underground Storage and Recovery Act and consolidated them into a single, unified program. The new program made the regulatory provisions easier to administer, established a unified accounting system for all water that is stored and recovered, and attempted to simplify the recharge program for potential applicants.

One of the major goals of the recharge program is to encourage the use of renewable water supplies by limiting the storage credits that can be accumulated over the long-term to water that cannot reasonably be used directly. A second goal of the program is to eliminate the need for the construction of costly distribution systems by allowing water that is stored in one location to be recovered in another location.

The recharge program provides for three basic types of permits that are needed to operate a facility: (1) a permit for the storage facility itself (storage facility permit), (2) a permit for storing the water at a given facility (water storage permit), and (3) a permit for recovering the water that is stored (recovery well permit). Water can be stored several different ways under the program. Constructed facilities allow for the storage of water through the use of injection wells or percolation basins; managed facilities, through the use of natural stream channels ("passive" recharge); and groundwater savings facilities, through use of renewable supplies in lieu of pumping groundwater.

In addition, the recharge program increases the marketability of long-term storage credits by allowing all credits to be bought and sold, whereas previously only those credits accrued through in-lieu recharge were allowed to be sold or transferred to another water user. The program also allows credits to be extinguished by municipal providers to achieve compliance with their Second Management Plan per capita conservation requirements.

Pursuant to A.R.S. § 45-852.01, effluent recharged at a managed underground storage facility may only receive credits for 50 percent of the recoverable volume if the recharged water does not benefit a national park, national monument, or state park. If effluent recharged at a managed underground storage facility benefits a national park, national monument, or state park, then 100 percent of the recoverable volume may be credited to the storer.

8.3.7 Arizona Water Protection Fund

Legislation was passed in 1994 to address several recommendations by the Governor's CAP Advisory Committee for increasing the state's use of CAP water. The legislation created the Arizona Water Protection Fund, administered by a commission, to issue grants to water users for implementing projects to protect the state's rivers and streams, including the use of excess CAP water for riparian enhancement.

In the Santa Cruz AMA funded projects include a hydrologic investigation of groundwater movement and baseflow sources along Sonoita Creek, the development of a wetland characterization and management plan for Potrero Creek, and efforts to restore riparian grasslands in southern Arizona.

8.3.8 The Augmentation and Conservation Assistance Fund

Through 1996, the Code allowed for an augmentation and conservation assistance fee of up to $2.00 per acre-foot per year to be levied on groundwater withdrawals. The Santa Cruz AMA's augmentation and conservation assistance fee began at $.50 per acre-foot in 1994 where it has remained. Monies collected from the fee have averaged about $42,000 per year since 1994, due to fairly consistent annual AMA water withdrawals.

These monies provide the basis for the augmentation and conservation assistance fund. The Second Management Plan stated that monies in the fund designated for augmentation would be used to provide: (1) cost-sharing grants for augmentation projects and studies initiated or conducted by private or public entities and (2) funds for augmentation projects and studies initiated or conducted by the Department.

Since the creation of the Santa Cruz AMA in 1994 up to 1997, seven grants have been awarded, five of which were conservation related. These grants have ranged from promoting conservation education through programs such as the Water Maze and Bear Essential News to augmentation projects such as the Tubac Ranch Properties grey-water wetlands. The United States Geological Survey gage station in Tubac is another grant awarded by the Santa Cruz AMA to monitor the flow of the Santa Cruz River and the various hydrologic influences on the river. In 1997, the City of Nogales was awarded a grant to promote conservation through a toilet rebate and plumbing retrofit program. This is the first grant awarded to a municipal provider in the Santa Cruz AMA to promote water conservation.

More detailed information on the seven grants as well as the augmentation and conservation assistance fund can be found in Chapter 9.

8.3.9 Applicability of Second Management Plan Augmentation Program to the Santa Cruz Active Management Area

Because multiple sources of water combine in the Younger Alluvial aquifer and CAP water and expansive surface water reservoirs are not available, there is limited usefulness in an augmentation program that directs itself to increase the use of renewable supplies. But the five elements of the Second Management Plan Augmentation Program are helpful. Because most of the effluent generated in the AMA is discharged into the Santa Cruz River and infiltrates and commingles with other sources of water in the aquifer, incentives to increase the direct use of effluent in the Santa Cruz AMA must carefully consider the potential impacts on local water table levels. The Department provided technical assistance during the second management period to determine the costs of extending the CAP canal, and has coordinated binational water management efforts with Mexico since the AMA was created. It is appropriate for the

Department to provide technical and coordination assistance and to continue to work to resolve legal and institutional barriers to water augmentation. Although the Second Management Plan augmentation program did not specifically address the augmentation issues of the Santa Cruz AMA, local conservation education efforts have been very successful in developing a sense of understanding of water management issues within the AMA community and the importance of water resource management. In addition, the Department has improved its understanding of the hydrology of the AMA through expanded monitoring efforts and the development of the Santa Cruz AMA hydrologic model.

8.4 PROGRAM DEVELOPMENT ISSUES

Augmentation in the Santa Cruz AMA will depend on the successful resolution of associated legal, political, physical, and economic constraints that impact water management in this area. The regulations of other agencies, the application of surface water and groundwater law in a combined aquifer system, and the difficulty in finding appropriate sites for recharge are all issues that must be addressed to fully develop and implement an augmentation program in the Santa Cruz AMA.

Augmentation activities in the Santa Cruz AMA could be affected to various degrees by the regulations and policies of ADEQ and/or the federal government (see Appendix 8). Some of these legal and institutional factors may be barriers to augmenting water supplies that will need to be resolved, while others may help the AMA achieve its management goals.

The severance and transfer of a surface water right which is converted from agricultural use to municipal or industrial use is permanent. The agricultural use will not be allowed to continue through the use of a groundwater right which was issued based on the same water use as the surface water right. To do otherwise would allow a substantial increase in overall AMA water demand and jeopardize the management goals of maintaining safe-yield conditions and preventing long-term declines in local water tables.

Locating potential areas where recharge can occur hydrologically, as well as legally, will be a challenge in the Santa Cruz AMA. Ensuring that stored water remains available for recovery by the water storer within the AMA, and preventing the storing and recovery of water from impacting other water users, and local water table levels, given the seasonal and annual fluctuations in water availability in the Younger Alluvium of the river, are issues that need resolution. The Department's hydrologic model may provide some answers or guidance in developing the Santa Cruz AMA augmentation program further. A management plan modification incorporating new knowledge of the AMA's hydrology is likely.

8.5 PROGRAM GOALS AND OBJECTIVES

In conjunction with the Santa Cruz AMA Groundwater Users Advisory Council (GUAC), the Department solicited the local community's perspective on the intent of the water management goal established by the Legislature. Frequently mentioned objectives included: (1) maintaining what currently appears to be a delicate balance between water use and water replenishment in the AMA; (2) recognizing that continued water resource development in Sonora will impact the AMA, the cooperative water management efforts between the U.S. and Mexico must continue to ensure adequate water supplies and improved distribution systems on both sides of the border while at the same time mitigating or minimizing any negative impacts on the AMA; (3) ensuring that those persons currently exercising their rights and those with senior surface water rights continue to have supplies physically available; (4) protecting significant portions of the rich riparian habitat that exists along the Santa Cruz River; and (5) ensuring that water is physically available to meet future demands. The Department accepts that all five of these objectives, to some extent, underlie the management goal specified by the legislature.

The principle water supply source presently utilized in the AMA is the Younger Alluvium of the Santa Cruz River. Because the most critical water management issues in the AMA center on the Younger Alluvium, the Department has focused its water management efforts there and on those tributaries and formations, including certain older alluvial formations, that contribute to recharge of the Younger Alluvium. Emphasis is placed on those alluvial areas which are: (1) subject to competing multiple use objectives, (2) most sensitive to changes in water levels, and (3) relied on for most of the region's water supply.

The goal of the Third Management Plan augmentation and recharge program for the Santa Cruz AMA is to promote water supply and distribution efforts which (1) maintain existing water resources to sustain current demands; (2) secure renewable water supplies for the purpose of maintaining safe-yield conditions, meeting committed demands, and supplying future needs; and (3) prevent long-term declines and stabilize local water tables in areas of concern.

During the third management period, several augmentation measures will be explored including: (1) possible water exchanges through state mechanisms such as the Arizona Water Bank; (2) the possibility of securing future effluent flow from Mexico, possibly with the assistance of a locally created water district; (3) the possible use of existing renewable supplies within the AMA such as water from Patagonia and Peña Blanca Lakes; (4) encouraging the exploration and investigation of potential sites for water storage, especially in areas outside the Younger Alluvium, due to the physical and legal issues associated with storing water within the Younger Alluvium; and (5) examining the potential to import water from outside of the Santa Cruz River basin. Proposed augmentation measures should be evaluated based on their cost and physical practicality in implementation. Completion of the Department's hydrologic model should assist in these efforts.

Ultimately, it is the Santa Cruz AMA community water users and water providers, however, who will determine what augmentation investments are made to assure adequate water supplies in the future. The Department's obligation is to assist in the development of augmentation measures in Santa Cruz AMA. The Department's role in the AMA includes developing, adopting and implementing regulatory programs to ensure efficient use of supplies, issuing recharge permits to monitor and assign credits to water storers, and ensuring that sufficient supplies exist to meet current and committed demand, and any potential future demand. By developing avenues from which local water interests can work together to promote improved water resource management and secure the long-term availability of water supplies to support existing and new development, the Department can help the Santa Cruz AMA to successfully maintain the conditions set forth in its management goal.

8.6 THE AUGMENTATION AND RECHARGE PROGRAM

The Department will be an active participant in water supply augmentation during the third management period. The principal responsibility for developing water supplies, however, will remain with the region's water providers. The creation of a local water district could assist in the resolution of economic, legal, physical, and institutional barriers encountered in attempting to augment water supplies in the Santa Cruz AMA. The Third Management Plan augmentation and recharge program includes eight main elements designed to assist water users in developing new water supplies:

- Regulatory Incentives
- Technical and Planning Assistance
- Coordination and Facilitation of Cooperative Efforts
- Resolution of Legal and Institutional Barriers
- Financial Assistance
- Siting Criteria for Underground Storage and Recovery Projects
- Purchase and Retirement of Grandfathered Rights

8.6.1 Statutory Provisions

For the Santa Cruz AMA, the augmentation program for the Third Management Plan has been developed under the following general statutory authorities of A.R.S. § 45-566:

> A. For the third management period, 2000-2010, the director shall promulgate a management plan for each initial active management area . . . The director:
>
> 6. Shall include in each plan a program for additional augmentation of the water supply of the active management area, if feasible, including incentives for artificial groundwater recharge.
>
> 9. May include in each plan a program for the purchase and retirement of grandfathered rights by the department to begin no earlier than January 1, 2006.

The recharge program for the Third Management Plan is derived from A.R.S. § 45-801.01, *et seq.*, the authority for the Underground Water Storage, Savings, and Replenishment Program. The provisions that affect recovery are found under A.R.S. § 45-834.01, with a special requirement under A.R.S. § 45-834.01(A)(2)(b) for consistency with the management plan in the case of recovery outside the area of impact of the stored water.

Funds for augmentation, conservation assistance, and water monitoring activities and for purchasing and retiring grandfathered rights are provided to the Department through the groundwater withdrawal fee, which is levied within the active management areas pursuant to A.R.S. § 45-611(C). Additional funds may be received for augmentation and conservation assistance and purchase and retirement of grandfathered rights through fees assessed for the temporary use of groundwater in artificial lakes as described under A.R.S. § 45-133(E).

In addition to these specific statutory authorities, the Department will continue to integrate augmentation objectives into the regulatory components of the management plan, the development and implementation of the assured water supply and other rules, and multiple non-regulatory activities that facilitate use of renewable water supplies.

8.6.2 Regulatory Incentives

Provisions established in the agricultural, municipal, and industrial conservation programs (chapters 4, 5, and 6, respectively) provide incentives to encourage water users in the AMA to use renewable water supplies, particularly effluent. The groundwater quality management program, in chapter 7, identifies methods to increase the water supply available in the AMA by increasing the use of poor quality water.

8.6.3 Technical and Planning Assistance

The Department will continue to support augmentation project construction, planning, and research activities during the third management period. Technical assistance will be provided to entities in assessing the need for augmentation projects, determining project feasibility, and reviewing project impacts. Department staff will participate on oversight committees, provide data, and review planning and feasibility study reports. To facilitate research projects, the Department will assist entities by initiating research activities, assisting in study design, providing data, reviewing results, and disseminating information. The Department hopes to be able to continue to expand the hydrologic model being developed for the Santa Cruz AMA to include adjacent portions of Sonora which are located within the Santa Cruz River watershed. These efforts are part of binational coordination to improve the hydrologic understanding of the Upper Santa Cruz basin and will help the Department to develop various water supply scenarios to guide water management decisions. Additionally, the Department will encourage the development of recharge sites in the older alluvium to augment mountain front recharge.

8.6.4 Coordination and Facilitation of Cooperative Efforts

The Santa Cruz AMA will emphasize studies focusing on recharge in areas determined to be most beneficial to meeting the goals of the AMA. Cooperative efforts among the participants will allow the development of more effective projects and studies. The Department will work with organizations to coordinate and facilitate augmentation activities. As part of this process, facilitation and coordination of recharge projects through a water district will be further explored and encouraged.

8.6.5 Resolution of Legal and Institutional Barriers

The Department will continue to work with interested parties in the AMAs and around the state to draft rules and propose legislation that will resolve legal and institutional barriers to augmentation activities. There are some water management needs that the Department can address with its existing statutory authorities, such as revising the well spacing and impact rules. The Department can also indirectly influence progress in some areas through support of legislation. For some issues, new statutory authorities for the Department may be necessary.

8.6.6 Financial Assistance

The augmentation and conservation assistance fund, as well as specifically budgeted appropriations, will provide financial assistance to entities for implementing augmentation projects or conducting studies that contribute to achieving the AMA's water management goal or resolving regional water management problems. This fund will also be available to fund projects for monitoring or assessing water availability within the AMA. More detailed information on the augmentation and conservation assistance fund, including how it will be administered during the third management period, can be found in Chapter 9.

8.6.7 Storage and Recovery Siting Criteria

The benefits to water management through the recharge program depend upon the location where water is stored and where it is recovered. Non-recoverable water storage is discussed in section 8.6.8.

For storage and recovery, A.R.S. § 45-834.01(A) provides that unless stored water is recovered by the storer within the area of impact of water storage, the recovery is only allowed "if the director determines that recovery at the proposed location is consistent with the management plan and achievement of the management goal for the active management area." Although the statute ties recovery to the consistency requirements of the plan, the locations of storage and recovery of water are inherently linked and must *both* be considered when determining whether the future recovery meets the consistency requirements and management goals of the AMA. It cannot be determined whether recovery is consistent with water management objectives of the AMA unless the storage location is also considered. Water management benefits to the AMA depend greatly on whether credits recovered from a well were accrued through storage in a remote area of the AMA or in a large pumping center of the AMA. Therefore, the criteria to determine whether a recovery location is consistent with the management plan and goal for the AMA must also consider where water was stored.

The locations of storage and recovery are important factors in addressing local supply problems, particularly in critical areas, and attempting to balance the distribution of water supplies in the AMA during the third management period. For example, the useful water supplies of the AMA may be diminished if water storage occurs in a location where there is no future demand for the stored water and recovery occurs outside the area of impact of storage. In addition, recovery away from the area of impact of water storage could aggravate problems if the area of recovery was experiencing rapidly dropping water levels or if the water supplies were already fully committed under the AWS Program.

Thus, while the Second Management Plan siting criteria provided no protection of water supplies already committed under the AWS Program, the new Third Management Plan criteria protect water supplies that are already committed for an assured water supply from an entity who wishes to recover water *outside* of the area of impact.

The Third Management Plan criteria also link future use benefits to determinations under the AWS Program. If storage occurs in a remote area, but one that has a committed and projected demand through a Designation or Certificate of Assured Water Supply, then it is deemed to contribute to water supplies that will be used in the future. If the storage does not meet this criterion, such as if the storage occurs in a remote area with no committed or projected demands under the Assured Water Supply Program, the storage must otherwise be beneficial to the AMA if recovery is to occur outside the area of impact of storage. If a storage facility does not meet the criteria, this concern would be incorporated in the storage facility permit as a notice to potential water storers that future recovery may only be allowed inside the area of impact.

A.R.S. § 45-834.01(A) provides that recovery may occur within the area of impact of the storage by a person other than the storer of the water or *outside* the area of impact of the storage by any person only if the director determines that recovery at the location is consistent with the management plan and achievement of the management goal for the AMA. Recovery must continue to be consistent with management plan criteria, even after the recovery well permit has been issued. Thus existing, previously permitted recovery wells are subject to the criteria of the Third Management Plan and future management plans.

8-101. Storage and Recovery Siting Criteria

During the third management period, for purposes of A.R.S. § 45-834.01(A)(2)(b), recovery of stored water at a location within the area of impact of the stored water by a person other than the storer and recovery of stored water at a location outside the area of impact of the stored water by any person is consistent with the management plan and achievement of the management goal for the AMA only if all three of the following three criteria are met:

1. *The water storage that resulted in the right to recover water meets one of the following criteria:*

   a. *The water storage is contributing to water supplies that are accessible to current water users or that have been committed to establish a Designation, Certificate, or Analysis of Assured Water Supply pursuant to A.R.S. § 45-576 or rules adopted thereunder.*

   b. *The water storage is a component of a remedial action project under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, and the director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the AMA.*

   c. *The water storage is otherwise determined by the director to have contributed to the objectives of this chapter or the achievement of the management goal for the AMA.*

2. *One of the following applies at the time the application for the recovery well permit is filed:*

   a. *At the time of the application, the Department's Assured Water Supply rules do not specify the maximum depth below land surface from which water may be withdrawn from a well in the Santa Cruz AMA for purposes of demonstrating physical availability of water withdrawn from a well.*

   b. *At the time of the application, the Department's Assured Water Supply rules specify the maximum depth below land surface from which water may be withdrawn from a well in the Santa Cruz AMA for purposes of demonstrating physical availability of water withdrawn from a well, and the projected depth to water at the location of the recovery well after 100 years does not exceed that maximum depth after considering: (1) the maximum proposed withdrawals from the recovery well; (2) withdrawals for current, committed, and projected demands associated with determinations made under A.R.S. § 45-576 that are reliant on the water which the recovery well will withdraw; and (3) withdrawals for other current or projected demands that are reliant on the water which the recovery well will withdraw.*

   c. *The recovery will be undertaken within the applicant's service area and the applicant is a municipal provider designated as having an assured water supply.*

3. *Recovery of the water meets one of the following criteria:*

   a. *The recovery will not cause the local water table to experience a long-term decline.*

   b. *The recovery is a component of a remedial action project under CERCLA or Title 49, Arizona Revised Statutes, and the director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the AMA.*

   c. *The recovery is likely to contribute to the water management objectives of the geographic area in which the well is located, as determined by the director.*

8.6.8 Criteria for Storage of Non-Recoverable Water

A.R.S. § 45-833.01(A) provides that "the director may designate a water storage permit as storing non-recoverable water. If the water storage occurs within an active management area, the water storage permit may be designated in this manner only if the storage is consistent with the active management area's augmentation program." Subsection B provides that water stored under such a permit "may not be recovered on an annual basis, may not be credited to a long-term storage account and may not be used for replenishment purposes." The same considerations discussed in the preceding section that shaped the criteria for recovery well location have shaped the criteria for non-recoverable storage.

8-201. Criteria for Storage of Non-Recoverable Water

During the third management period, water storage that is designated as non-recoverable is consistent with the AMA's augmentation program if one of the following criteria is met:

1. *The water storage is contributing to groundwater supplies that are accessible to current water users or that have been committed to establish a Designation, Certificate or Analysis of Assured Water Supply pursuant to A.R.S. § 45-576 or rules adopted*

thereunder so long as the areas in which water is stored are not experiencing problems associated with shallow depth to water.

2. *The water storage is a component of a remedial action project under CERCLA or Title 49, Arizona Revised Statutes, and the director has determined that the remedial action will contribute to the objectives of this chapter or achievement of the management goal for the active management area.*

3. *The water storage is otherwise determined by the director to contribute to the objectives of this chapter or the achievement of the management goal for the active management area.*

8.6.9 Recharge Activities

As noted in the AMA assessment portion of this chapter, there are several issues which could limit the ability to recharge water in the Santa Cruz AMA. This is not meant to suggest that recharge cannot occur under any circumstances. Instead, these issues need to be integrated and further addressed to explore future courses of action.

8.6.9.1 Alternative Approaches

This section is intended to illustrate some of the implications associated with different scenarios for a hypothetical recharge project associated with the NIWWTP, which is currently one of the most important sources of renewable water supply (effluent) in the AMA. It should be noted that these alternatives do not take into account the availability of effluent from Mexico or other variables outside of the Department's control. These are not meant to represent the only recharge options for the AMA, as these are discussed in section 8.6.8.2 as potential recharge sites, but merely the benefits and negative consequences of such actions based on the statutory direction given the Department and the existing regulatory framework.

8.6.9.1.1 Alternative 1

The first approach is to continue discharging effluent into the Santa Cruz River at the NIWWTP and establish the downstream portion within the AMA as a managed underground storage facility.

One benefit of this approach is that it would serve as a firm, continuously available supply for new development downstream of the NIWWTP if new developments were to obtain these credits in adequate amounts. Depending on locations for recovery, it could also support the maintenance of downstream water tables and riparian habitat. However, many legal, technical and hydrologic issues would need to be resolved before a project is approved under this alternative.

8.6.9.1.2 Alternative 2

This approach would pipe effluent to a constructed underground storage facility upstream of the NIWWTP to either Guevavi Ranch or Kino Springs.

Adopting this approach would provide a more stable, physically available supply for the City of Nogales. However, it would suffer from the limited storage capacity in the Younger Alluvium microbasins. Water levels downstream from the NIWWTP could also be impacted by the direct diversion to upstream locations. In addition, it is difficult to conceive of a method by which long-term credits could be accrued due to the rapid movement of the recharged water out of the area when the microbasins area full. Careful management of recharge in this area would need to occur to ensure that recharged water remained in the location of storage. This alternative will also include costs associated with construction of transmission lines.

8.6.9.1.3 Alternative 3

Another option would be to pipe the effluent from NIWWTP to an underground facility at the City of Nogales Potrero Creek wellfield.

This would provide a more stable, physically available supply for the City of Nogales and might assist in maintaining the wetland in the area. Water levels downstream from the NIWWTP, however, could also be impacted by the direct diversion away from the river. Recharge in this area could impact the migration of the contaminant plume from the United Musical Instruments Resource Conservation and Recovery Act (RCRA) site, which could negatively impact water quality. As with Alternative 2, transmission line costs would be associated with this alternative.

8.6.9.2 Considerations in the Location of Potential Recharge Sites

As part of third management period activities, the Department will work with the local community to identify and prioritize potential recharge sites. The best location for artificial recharge may be outside of the Younger Alluvium. The ideal location would be one that:

- provided hydrologic conditions conducive to long-term water storage
- allowed water to be economically transported to the storage site
- allowed reasonable recovery of the stored water
- is in reasonable proximity to the end use of recovered water
- will assist in maintaining safe-yield conditions and preventing long-term declines in local water table levels

Once sites have been evaluated, mechanisms for facilitating construction of these projects must be developed. Successful artificial recharge may include recharging water in the Older Alluvium and recovering water in the Younger Alluvium. Augmentation efforts may be most effective if recharge is focused on mountain front and tributary areas in the Older Alluvium and if recovery occurs in such a way that it does not significantly reduce water flow in the Younger Alluvium.

Artificial recharge may be used to help maintain local water table levels and provide a more continuous supply near centers of demand. Demand centers in the Santa Cruz AMA are located in Potrero Creek, along Highway 82 in the microbasins, and at Rio Rico, Tubac, and Amado. There are challenges associated with attempting to recharge water at each of these locations.

Siting a recharge project at Potrero Creek is complicated by the suspected dual aquifer system, and possible water quality concerns. Recharge in the microbasins would be of limited volume due to the limited storage capacity in this area. Because of the high transmissivity of the microbasins, water quality may be a concern if the recharge water is not of extremely high quality. Because of the high water table in the Santa Cruz River near Rio Rico, recharge in the Younger Alluvium of the river in this area is limited in capacity. However there may be possibilities for recharge in the tributary canyons in this area. Additional research and analysis of these canyons is needed to determine their suitability for recharge. A similar situation is present in the Tubac area, where recharge in tributary canyons may be the most suitable location but additional information to reveal the best locations is needed. Even less information is available for the Amado area. Since growth in this area is not as rapid as in the Nogales, Rio Rico, or Tubac areas, the need for recharge is not currently as great in this location, but will be needed in the future.

The Department does not currently have sufficient information to make recommendations on the most suitable locations for artificial recharge in the Santa Cruz AMA. There is a need for additional research and analysis to be performed in this regard, not only by the Department but by individual interested parties as well. Seeking suitable locations for artificial recharge is a task that could be performed by a water district. Limited funding may also be made available from the Santa Cruz AMA Water Management Assistance Program (see Chapter 9).

8.6.9.3 Other Possibilities for Augmentation and Recharge

In addition to constructing artificial storage and recovery projects at various locations throughout the AMA, the Augmentation and Recharge Program for the Santa Cruz AMA Third Management Plan must explore the possibility of expanding the capacity of existing reservoirs and creating additional capacity for surface water and effluent to be stored. This needs to be explored not only in the Younger Alluvium, but in the Older Alluvium.

8.6.10 Purchase and Retirement of Grandfathered Rights

The possibility of the Department purchasing grandfathered rights and then retiring them is a program the Department considered for inclusion in the Third Management Plan beginning in 2006 pursuant to A.R.S. § 45-566(A)(9). However, after analyzing the few rights that would be likely to be offered for sale through such a program, the cost of maintaining the retired land, and the projected water savings versus the cost to purchase and retire the rights, a purchase and retirement program is not feasible under current conditions for the Santa Cruz AMA. Another more promising approach, given the surface water nature of the Santa Cruz AMA, is the potential development of programs to reimburse farmers for fallowing their fields during drought periods to make limited water supplies available for municipal uses. Given the highly seasonal and annual fluctuations in water availability in the Santa Cruz AMA, a program that is responsive to these fluctuations is more appropriate than a purchase and retirement program. A water district in the Santa Cruz AMA could also implement such a program.

8.7 FUTURE DIRECTIONS

Water augmentation activities that assist in maintaining the Santa Cruz AMA goals would be greatly assisted by adjusting current programs and developing new programs. The development of consistency with AMA goal criteria in the AWS Rules, general well spacing criteria, additional well spacing criteria consistent with the Santa Cruz AMA goals, and data collection and research projects developed through the Third Management Plan Water Management Assistance Program for the Santa Cruz AMA will all contribute to answering the challenges associated with augmentation and recharge projects in the Santa Cruz AMA.

The Department's role in water management activities has been and will continue to be to provide regional water management coordination; sponsor and coordinate technical committees that address regional water policy development, planning, and water management; implement and enforce water conservation programs; provide technical assistance; perform studies; issue and convey water rights; distribute water management assistance funding, and develop and issue policies under the purview of the Code and surface water law, among others.

However, additional statutory authorities may be needed to ensure achievement of the Santa Cruz AMA's water management goals and objectives, including local water table level maintenance. The creation of a water district could greatly assist in efficiently managing and distributing current as well as developing new sources of supply. In order to fully utilize the sources of supply available to the Santa Cruz AMA, more creative thinking is needed. The Department and the AMA community must learn to find other sources outside the Younger Alluvium, which could begin with research to learn more about the Older Alluvium. A key to augmentation in the Santa Cruz AMA is probably to find ways to recharge effluent in high demand locations such as Potrero Canyon and Highway 82, as well as other major pumping zones, in order to effectively utilize current supplies. Another key is effective use of effluent that originates in Mexico and working cooperatively with the Mexican government to secure this supply into the future. These ideas are discussed further in Chapter 12.

The creation of a water district or other entity could provide assistance to water users in proving an assured water supply by firming supplies pledged for designations and certificates and perhaps even distributing water more evenly throughout the AMA as needed. Such an entity could be used as a basis for managing a master water contract with the owners of effluent, including the Mexican government, to allocate this supply for the maintenance of water level conditions and in exploring other augmentation possibilities, including recharge and importing additional supplies. Assured water supplies could then be determined based on the additional water supplies that would be made available and finances could be managed to support the effort.

8.8 CONCLUSIONS

The focus of this chapter has been on defining the Department's role in augmenting the water supplies of the Santa Cruz AMA for the third management period. However, it is not yet clear what the nature of an augmentation program for this AMA should be. The Santa Cruz AMA's augmentation program differs in its make-up from the other AMAs with regard to both its regulatory and physical nature.

The augmentation issues summarized in this chapter show that there is continuing need for active participation by the Department in determining appropriate augmentation activities to facilitate achievement of the AMA's water management goals and objectives. Many of the current augmentation mechanisms developed in the Second Management Plan were designed to introduce a variety of renewable water supplies, in particular CAP water, to water users in central Arizona, a sizeable distance away from the Santa Cruz AMA. Knowledge of the impacts of augmentation activities is not as extensive in the Santa Cruz AMA as it is in other AMAs based on the unique hydrology of the area.

The aquifer systems of the Santa Cruz AMA are generally shallow, with limited storage capacity, and are highly sensitive to prolonged periods of drought. These systems also rebound rapidly when sufficient recharge is introduced. The largest portion of the system is also heavily dependent on the continuation of effluent flow from Mexico to sustain current water levels.

New water demands and the uncertain future availability of Mexican effluent highlight the need for the local community to work together with the Department to secure this and other renewable supplies, where available, to achieve and maintain the management goals of the Santa Cruz AMA. The Department is and will continue lending its technical expertise and full resources to the exploration of solutions to the water resource management concerns of the Santa Cruz AMA community.

APPENDIX 8
OTHER PROGRAMS AND REGULATIONS
THAT MAY INFLUENCE AUGMENTATION ACTIVITIES

There are many other programs and regulations that could influence augmentation activities during the third management period. Most of the important factors are discussed in Chapter 8. This appendix summarizes additional regulatory and institutional programs that may influence augmentation activities in the Santa Cruz AMA.

8A.1 Arizona Department of Environmental Quality Regulations

ADEQ regulations that may affect augmentation activities include the rules for aquifer protection permits (APPs) and wastewater reuse permits.

8A.1.1 Aquifer Protection Permits

An APP from ADEQ is needed by a new or an existing facility that disposes of pollutants to the land surface, the underlying soil, or to groundwater in order to prevent the groundwater contamination that would otherwise result, if there is a reasonable probability that the pollutants would reach the aquifer. There are general and individual APPs. The APP rules include special provisions for recharge and require ADEQ to advise the Department of permit applications received for individual APPs for underground storage facilities.

There are numeric water quality standards for certain inorganic and organic chemicals, radio nuclides, and microbiological pollutants that may not be exceeded within an aquifer. In addition, there are narrative standards that state that a discharge shall not: (1) cause a pollutant to be present within an aquifer classified for a drinking water protected use in a concentration that endangers human health, (2) cause or contribute to a violation of a surface water quality standard established for a navigable water of the state, and (3) cause a pollutant to be present within an aquifer that impairs existing or reasonably foreseeable uses of the groundwater.

The impact of the APP rules on future effluent use in the Santa Cruz AMA could be extensive, depending on any changes or additions to the numeric standards list, or the extent to which the narrative standards are interpreted. For example, the recharge of effluent could be constrained if numeric standards for total dissolved standards were to be added to the list. Conversely, it could lead to increased direct use of effluent.

8A.1.2 Wastewater Reuse Permits

Direct use of treated wastewater (effluent and industrial wastewater) may occur only if a wastewater reuse permit is granted by ADEQ. A wastewater reuse permit is intended to ensure that the use of treated wastewater will not adversely affect human health, water supplies, or the environment. For example, a wastewater treatment plant operator or the user of the effluent must apply for a permit from ADEQ before effluent can be released from the treatment plant for reuse. The treatment plant operator or the user of the effluent is responsible for meeting the conditions of the wastewater reuse permit, as set forth in a legally enforceable contract between them.

The reuse rules specifically prohibit the use of treated wastewater for direct human consumption. However, there are reuse standards established for orchards, fiber seed and forage, pastures, livestock watering, processed food, landscaped areas, food consumed raw, incidental human contact and full body contact uses, greywater uses, wetlands, marshes, and industrial reuse. Depending upon the use and disposal of the wastewater, an APP or a National Pollutant Discharge Elimination System (NPDES) permit may also be required.

ADEQ is currently revising the reuse rules. The revised rules may have an impact on augmentation activities in the Santa Cruz AMA by expanding the options for direct use of effluent.

8A.2 Federal Regulations

Federal regulations affecting augmentation activities include compliance with the Endangered Species Act, Safe Drinking Water Act, and the Clean Water Act.

8A.2.1 Endangered Species Act

Endangered and threatened species are protected by the Endangered Species Act (ESA) and will need to be considered prior to development of augmentation projects. Candidate species are those that the United States Fish and Wildlife Service (USFWS) is considering adding to the threatened or endangered species list. Section II.H, "Biological Resources," of the ESA indicates the endangered, threatened, and candidate species that occur in the vicinity of proposed projects. Category 1 candidate species are those for which USFWS has enough information to support a proposal to list them, and Category 2 candidate species are those for which USFWS does not have enough information to support a proposal. Although candidate species have no legal protection under the ESA, they need to be considered in the planning process in the event they become listed or proposed for listing prior to project completion. Any listed or candidate species within an area of proposed impact related to a federal project, such as the CAP, typically requires coordination with USFWS under the Fish and Wildlife Coordination Act.

Several populations of the endangered Gila topminnow have become established along the effluent-dominated reach of the Santa Cruz River. The USFWS is also in the process of determining the status of the yellow-billed cuckoo, which apparently occupies riparian habitat along the upper Santa Cruz and upper San Pedro Rivers.

8A.2.2 Safe Drinking Water Act

Safe Drinking Water Act (SDWA) treatment standards have an impact on surface water. ADEQ is the designated agency of the state to administer the federal Safe Drinking Water Act, and in this capacity ADEQ will have to decide whether recovered water that was stored in an underground storage facility is considered "groundwater under the influence of surface water." Such water must be treated according to the drinking water rules that apply to surface water, whereas groundwater currently does not need to be treated unless it fails to meet primary drinking water standards. A decision has not been issued on this matter. If this is determined to be the case, wells in the Santa Cruz AMA may need to be treated pursuant to SDWA standards, since the AMA's Younger Alluvial Aquifer is strongly influenced by surface water flow.

The Water Infrastructure Finance Authority (WIFA) is a funding program created by the SDWA that could assist the Santa Cruz AMA by helping to pay for water treatment infrastructure costs.

8A.2.3 Clean Water Act

There are two sections of the Clean Water Act that may affect augmentation activities. These sections pertain to National Pollutant Discharge Elimination System permits and dredge and fill permits.

8A.2.4.1 NPDES Permits

Pursuant to Section 402 of the Clean Water Act, ADEQ administers the certification of NPDES permits for the United States EPA. The NPDES Permit for Point Sources of Pollution, as defined by ADEQ, protects the waters of the state from pollutants discharged from a point source. The waters of the state include all perennial or intermittent streams, lakes, ponds, impounding reservoirs, marshes, watercourses, waterways, wells, aquifers, springs, irrigation systems, drainage systems and other bodies or accumulations of surface, underground, natural, artificial, public or private water situated wholly or partly in or bordering on the state.

A NPDES Storm Water Permit may be also be required for certain industrial and construction activities that discharge storm water. NPDES permits are usually applied to effluent or industrial wastewater being disposed of by discharge to the waters of the state. However, when wastewater is proposed for a reuse application, such as recharge, the ADEQ wastewater reuse and APP rules are applied.

The NIWWTP has maintained a NPDES permit and recently filed an application to renew its NPDES permit. The permit renewal application is currently in the appeal and discussion process. NPDES permits are required to be reviewed every three years. No problems are anticipated with the review, since the facility expansion plans for the plant address storm flow discharge into the Santa Cruz River.

8A.2.4.2 Dredge and Fill Permits

Section 404 (Wetlands) of the Clean Water Act requires that the United States Army Corps of Engineers, with the concurrence of the United States EPA, issue or deny permits for activities that result in the discharge of dredge or fill material into the waters of the United States. Waters of the United States include most streams, stream channels and wetlands in Arizona. Intended to prevent the unlawful filling of wetlands, section 404 would apply to any channel modification made for managed underground storage facilities. Section 404 permits must be certified by ADEQ, under section 401 of the Clean Water Act. Certification depends on a review solely to determine whether the effect of the discharge will comply with the water quality standard.

CHAPTER

9

Water Management Assistance Program

9.1 INTRODUCTION

The Arizona Department of Water Resources' (Department) Water Management Assistance Program is intended to provide financial and technical resources to assist water users in meeting their conservation requirements, facilitate replenishment of the water supply, and obtain information on hydrologic conditions and water availability in the Active Management Area (AMA). This program is funded primarily through a portion of the water withdrawal fees paid annually by persons withdrawing water from wells in conjunction with filing their Annual Water Withdrawal and Use Report. The Water Management Assistance Program consists of the following: the Conservation Assistance Program, the Augmentation Assistance Program, and the Monitoring and Assessment Program. Conservation and augmentation assistance and information on hydrologic conditions acquired through monitoring and assessing water availability are essential tools in achieving the Department's water management goals. These goals include the efficient use of all water supplies, maintaining safe-yield conditions, and preventing long-term declines in local water table levels.

Conservation assistance is provided primarily in the form of financial assistance. However, it also includes planning and technical support and information and education services. Conservation assistance will continue to serve as a balance to enforcement actions during the third management period.

Augmentation assistance involves providing funds for projects that supplement the water supply of the AMA or that provide information to resolve technical feasibility issues or to optimize operation of recharge projects. Assistance includes studies initiated or conducted by the Department, cost sharing grants for augmentation projects, and studies initiated or conducted by others. Assistance may also include planning and technical support for AMA-wide and local area water management strategies.

Monitoring and assessment activities include providing staff assistance and funds for water supply and monitoring studies.

This chapter includes the following sections:

- Statutory Provisions
- Department's Role in the Water Management Assistance Program
- Second Management Plan Program Summary and Assessment
- Third Management Plan Program Goals and Objectives
- Allocation of Program Funds
- Future Program Direction

9.2 STATUTORY PROVISIONS

9.2.1 Program Authorization and Funding

The Groundwater Code (Code) requires that the Third Management Plan include a program for "additional augmentation of the water supply of the active management area, if feasible, including incentives for artificial groundwater recharge" and "a program for conservation assistance to water users within the active management area." A.R.S. § 45-566(A)(6) and (8). Funding for these programs comes primarily from groundwater withdrawal fees levied and collected pursuant to A.R.S. § 45-611(C). Other sources of funding include one-half of the annual surcharge collected by the director from persons holding a permit for interim groundwater use in bodies of water within the AMA and application fees for underground storage facility permits, groundwater savings facilities permits, water storage permits, and recovery well permits. A.R.S. §§ 45-133(E) and 45-871.01(A).

All fees received by the Department for the Water Management Assistance Program must be transmitted to the state treasurer. A.R.S. § 45-615. The state treasurer is required to hold the fees in a separate fund and to maintain within the fund separate accounts for each AMA. A.R.S. § 45-615(1). Monies held in the fund for an AMA may be used only to finance the augmentation and conservation assistance programs that are part of the management plan for the AMA and to fund any projects that are authorized by the director for monitoring and assessing water availability within the AMA. A.R.S. § 45-613(A).

The director is authorized to provide monies from the fund through grants rather than through the state's Procurement Code for augmentation or conservation assistance projects that will benefit the AMA in which the monies were collected. A.R.S. § 45-617.

9.2.2 Groundwater Withdrawal Fees

The groundwater withdrawal fee is levied and collected from each person who withdraws groundwater from a non-exempt well within the AMA, except persons who withdraw groundwater for use on a farm with ten or fewer irrigation acres. In the Santa Cruz AMA, the director collects an annual withdrawal fee from each person withdrawing water, other than stored water, from a well. The annual withdrawal fee is considered a groundwater withdrawal fee in the Santa Cruz AMA. A.R.S. § 45-611(A). No later than October 1 of each year, the director is required to set the groundwater withdrawal fee for an AMA for the following year. A.R.S. § 45-614(A). Prior to setting the fee, the Groundwater Users Advisory Council (GUAC) for the AMA recommends to the director how the fee should be set within the statutory limit.

Within 30 days after setting the fee, the director is required to give written notice of the fee to all counties, cities, towns, private water companies, political subdivisions, and holders of groundwater withdrawal permits in the AMA. A.R.S. § 45-614(C). The fee is required to be paid to the Department at the time the person withdrawing the water files an annual report pursuant to A.R.S. § 45-632. A.R.S. § 45-614(E).

Groundwater withdrawal fees for administration and enforcement of the Code have been collected since 1990. This first year assessment was to initiate the augmentation assistance program adopted as part of the Second Management Plan. In 1991, the Second Management Plan was modified to include a conservation assistance program which also became eligible for funding.

Table 9-1 shows the total water withdrawn, annual groundwater withdrawal fees, and total fees collected for the program from 1990 through 1997 in the Santa Cruz AMA.

9.3 DEPARTMENT'S ROLE IN THE WATER MANAGEMENT ASSISTANCE PROGRAM

The Department's role in the Water Management Assistance Program is to:

- review and provide input on project proposals
- develop project proposals
- implement Department projects
- prioritize projects that best meet the AMA management objectives
- provide technical and field assistance
- provide information and educational services
- promote the exchange of information among entities implementing the projects
- administer intergovernmental agreements (IGAs), contracts, and grants as described in this chapter

TABLE 9-1
GROUNDWATER WITHDRAWAL FEES[1] COLLECTED FOR WATER MANAGEMENT ASSISTANCE PROGRAM SANTA CRUZ ACTIVE MANAGEMENT AREA

Year	Water Withdrawn from Wells[2] (Acre-Feet)	Withdrawal Fee (per Acre-Foot)	Monies Collected
1990	18,999	$1.00	$18,002
1991	18,892	1.75	31,325
1992	15,589	1.85	26,986
1993	15,593	2.00	31,077
1994	23,533	2.00	47,863
1995	20,921	2.00	39,752
1996	22,499	2.00	45,136
1997	20,773	2.00	40,346
Average	19,600	1.83	35,061

[1] Withdrawal fees and fees collected reflect only that portion of the groundwater withdrawal fee established to support the Water Management Assistance Program. Total withdrawal fees through 1997 have been greater than Table 1 fees, since the first one dollar per acre-foot of the annual withdrawal fee was established for general Department administrative purposes.
[2] The figures in the groundwater pumped column reflect the most recent information available in the AMA. This information may vary from the figures used at the time the groundwater withdrawal fees were actually collected.

A complete description of how projects are prioritized and selected and how funds are allocated is found in section 9.6.

9.3.1 Fund Management and Administration

Fund management and administration of grants and contracts are coordinated between the Department's Administrative Services Division and the AMA. The centralized functions include management of the separate funds for each AMA and contract administration. The AMA staff initiate and support the grant application and review process and serve as the technical administrators for most grants and contracts.

9.3.2 Contract Development, Monitoring, and Support

Each applicant proposal accepted for funding must enter into a contractual agreement with the Department. Contracts are prepared by Department staff consistent with the applicant's proposal and scope development. The contract describes what tasks are to be accomplished and sets deadlines for task completion and fund disbursements. Department staff track progress and review deliverables for compliance with contract requirements. The Department authorizes and issues payments, modifies contracts as needed, and provides other legal and administrative support.

9.3.3 Information and Education Service

The Department's Web site serves as an information clearinghouse and the primary public venue for dissemination of current information on the Water Management Assistance Program. Information gained through Department sponsored programs, which are deemed to be regionally, statewide, and/or nationally transferable, will be placed on the Department's Web site and updated regularly. An additional focus will be linking the Department's Web site to other pertinent Web sites. This will assist users in finding water conservation, water supply, and augmentation information from other sources. In addition to a computer-based information clearinghouse, a centralized clearinghouse would include a library of conservation and augmentation literature as well as detailed information on grants and contracts funded and would provide centralized water conservation outreach activities.

The AMA office is responsible for developing water conservation information materials, educational curricula and displays, and programs specific to water users within the AMA. These materials may be developed independently with conservation assistance funding (e.g., grants or contractual agreements with consultants) in cooperation with other AMAs or through partnerships with other government agencies, community groups, or utilities.

The AMA office is also responsible for maintaining inventories of information and educational materials for distribution to water users within the AMA. Conservation-related presentations to schools, civic and other groups, and participation at local events are generally the responsibility of the AMA staff.

9.3.4 Assistance Activities

Assistance activities may include providing general or specific advice, performing research, assisting in the development of conservation and water management programs, and providing field or other technical support. AMA staff also provide support for augmentation and recharge activities including technical assistance and facilitation of regional planning efforts.

9.4 SECOND MANAGEMENT PLAN PROGRAM SUMMARY AND ASSESSMENT

9.4.1 Second Management Plan Conservation Assistance Program

The Second Management Plan identified four conservation program categories to be the focus of the grants program. They were:

- Information and Education
- Agricultural Users Program
- Municipal Users Program
- Industrial Users Program

The Second Management Plan required that at least one conservation project be funded in each category during the second management period. Through 1998, the Santa Cruz AMA has funded seven projects and distributed $85,438 in funds. The number of grants in each of the funding categories and the funding amounts are listed in Table 9-2. A more detailed classification of grants funded is described below.

Education - Four grants totaling $17,138 were awarded to develop water resources and conservation programs for children in grades one through eight using publications and laboratory worksheets available in English and Spanish.

Municipal - One grant of $15,000 was awarded for the purpose of creating a residential, non-residential, and municipal water conservation program for the City of Nogales.

Monitoring - One grant of $39,500 was awarded to construct a continuous-recording streamflow gage at Tubac.

TABLE 9-2
CONSERVATION ASSISTANCE GRANTS AWARDED
1990-1998
SANTA CRUZ ACTIVE MANAGEMENT AREA

Category	Number of Grants	Funding Totals
Education	4	$17,138
Municipal	1	$15,000
Monitoring	1	$39,500
Re-use	1	$13,800
Total	**7**	**$85,438**

Re-use - One grant of $13,800 was awarded to a wetlands-based reuse project at Tubac Ranch.

9.4.2 Second Management Plan Augmentation Assistance Program

Through the 1998 grant cycle, no augmentation projects have been funded in the Santa Cruz AMA.

9.4.3 Second Management Plan Program for Monitoring and Assessment

Statutory authorization making these types of projects fundable under this program was given in 1996. Projects in this category do not have to follow the previously described grant funding process. The Department may utilize funds from withdrawal fees, if, in the opinion of the Department, such a project is critical to the needs of the agency.

9.4.4 Second Management Plan Program Assessment

The Water Management Assistance Program has been in operation for seven years. As previously described, projects in the education program category have been funded under this program. The mark of a good program is whether it is achieving the objectives established for it. This section will generally assess the accomplishments of the program. This assessment will be used to reaffirm or reshape the program, as necessary, for the third management period. This general program assessment was conducted for the following reasons:

- The creation of the Santa Cruz AMA in 1994 with its unique dual goal of maintaining safe-yield conditions and long-term local water table levels may require a re-adjustment in the allocation of funds to better assist in the achievement of the dual goal.

- Much time and money have been invested in this program. With that investment, it is good policy to determine what has and has not been successful in order to provide direction for future program efforts.

9.4.4.1 Attainment of Program Goal/Objectives

The goal of the Water Management Assistance Program has been to assist water users and others in achieving the management plan conservation requirements and in developing augmentation and recharge projects in order to maximize the use of renewable resources. This may be achieved by identifying and carrying out high priority projects, providing funds for the development of such programs, acting as a central source of information, and increasing public awareness of the importance of water conservation and renewable resource development.

9.4.4.1.1 Priority Projects

The AMA currently establishes annual funding priorities, based on consultation with the GUAC and other members of the water using community. Applications for funding under these priority categories receive stronger consideration in the review and selection process. During the first four years of this program, funding priorities were not set. Any application that met the Second Management Plan review criteria had an equal opportunity for funding. Funding priorities were established for the Santa Cruz AMA in 1996. Up to $3,000 of discretionary funding was made available for conservation assistance and education purposes. Funds were also prioritized for the purchase of continuous water level recorders and for a geophysical survey of the northern portion of the AMA. The Santa Cruz AMA has continued to earmark up to $3,000 per year for conservation assistance and education; however, this amount has not been spent in each year from 1996 to the present. In 1999, some additional priorities were proposed at a GUAC meeting. These included studies to determine possible locations and types of augmentation or recharge projects.

9.4.4.1.2. Providing Funds

The Department has made all funds collected for this program available for award. A small percentage of total funds collected is used by the Department to provide legal and administrative support to the program. Although all funds collected have been made available, all funding has not been awarded. In most years, the amount of funding available has exceeded the amount requested by applicants receiving GUAC recommendation. However, major projects with many water management benefits require several years worth of funding. For this reason, grants may not be offered in some years in order to collect sufficient funds to address a major water management issue in the future.

9.5 THIRD MANAGEMENT PLAN PROGRAM GOALS AND OBJECTIVES

9.5.1 Third Management Plan Conservation Assistance Program

The goal of the Conservation Assistance Program is to assist water users and other eligible persons within the Santa Cruz AMA in achieving the conservation requirements of the management plan. The Department will meet this goal by working towards the following program objectives:

- Identify high priority funding areas in consultation with the GUAC and the water using community and carry out priority programs.
- Provide funds for the development of conservation assistance programs for agricultural, municipal, and industrial water users and for information and education on water conservation.
- Act as a central source for information on water conservation.
- Increase public awareness of the importance of water conservation.

9.5.2 Third Management Plan Augmentation Assistance Program

The goal of the Augmentation Assistance Program is to assist water users and other eligible persons within the Santa Cruz AMA in developing augmentation/replenishment projects in order to help maintain safe-yield conditions and prevent long-term declines in local water table levels. The Department will meet this goal by working towards the following program objectives:

- Identify high priority funding areas in consultation with the GUAC and the water using community and carry out priority programs.

- Provide funds for the planning, design, and construction of replenishment projects.
- Act as a central source for information on augmentation/replenishment project options.
- Increase public awareness of the importance of augmenting/replenishing AMA water supplies.

9.5.3 Third Management Plan Program for Monitoring and Assessing

The goal of this program is to assist in identifying, establishing, and implementing programs that monitor and assess the hydrologic conditions and the potential impacts of continued water withdrawals and water level declines in the Santa Cruz AMA. The Department will meet this goal by working towards the following program objectives:

- Identify high priority funding areas in consultation with the GUAC and the water using community and carry out priority programs.
- Provide funds for the purchase and installation of monitoring equipment, including well meters, continuous well water level recorders, and stream gaging stations.
- Act as a central source for information on monitored conditions.

9.6 DEPARTMENT'S ROLE IN WATER MANAGEMENT ASSISTANCE PROGRAM

The Department's role in the Water Management Assistance Program is to direct the program by identifying areas in need of technical or financial assistance, establishing assistance priorities, soliciting and reviewing projects for funding, developing contractual arrangements, providing administrative and logistical support, reviewing deliverables, monitoring progress, and providing access to results. The Department may also propose projects, which may be performed by outside entities or by Department personnel. The Department may also use funding to obtain equipment for water management monitoring.

9.6.1 Annual Assistance Priorities

In an effort to apply available funding and technical assistance to the most important projects, the AMA identifies annual program priorities. With assistance from members of the water using community and the GUAC, high priority categories are identified. Any projects identified for funding in these categories receive preference during the application review and selection process.

9.6.2 Application and Review Process

An extensive mailing list is used for notification that the annual grant application process has begun. The notice identifies funding categories, priorities, application review criteria, application submittal and review schedules, and funding levels. Once applications are received, AMA staff conduct their review. AMA staff also provide logistical and technical support to the GUAC during their concurrent review. Generally, an initial screening of applications is conducted by the GUAC. Applications most consistent with the established funding priorities are retained for further consideration. Those applicants making the "first cut" are invited to make a presentation to the GUAC. Subsequent to the presentations and application reviews, the GUAC selects which applicants should receive funding and forwards their recommendations to the Department director. The director then makes the final determination as to which applications will be offered a contract.

9.6.2.1 Conservation Assistance Proposal Selection

The selection criteria to be used in the Santa Cruz AMA by the GUAC and the director to evaluate conservation assistance proposals are listed below. Certain criteria may be given greater weight, and any weighted system will be applied consistently. There are three mandatory evaluation criteria and additional criteria that may be used in project selection.

Mandatory Evaluating Selection

1. Compliance of the project with applicable laws and administrative regulations. In the case of regulated water users, the extent to which this project helps to reach Third Management Plan conservation requirements.

2. Cost effectiveness of the project. Ability to combine the project with proposed or ongoing projects resulting in cost and human resource savings. Ability of the project proponent to obtain matching funds for the project. Extent to which the applicant is contributing to the cost of the project (e.g., in-kind or cash). Predicted water demand reduction. Extent and duration of reduction relative to project costs.

3. Compatibility of the project with the Department's policies and programs and the water management goals of the Santa Cruz AMA.

Additional Evaluation Selection Criteria

4. Extent to which the type of project is applicable to other users, other sectors, and other AMAs.

5. Likelihood of community support for the project. Demonstrated sector commitment to participate in the project.

6. Significance of the project's potential economic, environmental, and social impacts.

7. Extent to which the type of project has previously been proven feasible and effective or extent to which implementation of the project will provide information on feasibility and effectiveness if not previously proven.

8. Demonstrated need. Is it likely the project would not be implemented without conservation assistance funding?

9. Ability to monitor demand reductions during and after implementation of the project. Ability to produce documented comparisons of pre- and post-project water savings, scientific data collection and reporting methods, or pre- and post-program surveys to verify project results.

10. Past performance of project proponent with regard to implementing conservation projects. Whether the applicant has experience and past success with similar projects.

11. Effectiveness of proposal. This includes factors such as a clear statement of purpose, goals, methodology, and list of deliverables (data collection, interim and final reports, etc.). Contains background on current and historic water use if applicable. Whether the proposal is innovative and includes sufficiently researched budget information to determine if the requested funding amount is warranted (e.g., salary costs and benefits, retrofit device costs, equipment purchases, and supplies).

Special Preference Points

The GUAC may choose to give special preference points to certain priority projects or may declare a "must fund" project which would receive first consideration for funding. These priorities may change from year to year.

9.6.2.2 Augmentation Assistance Proposal Project Selection

Augmentation projects in the Santa Cruz AMA relate to the use of effluent supplies, the capture of excess surface water flow that is not claimed by right holders and the replenishment of water withdrawn from wells. Each augmentation assistance project grant proposal will be evaluated according to the criteria established by the director in consultation with the GUAC. Evaluation criteria include, but are not limited to:

- Compatibility with current Department programs and policies and consistency with the management goals
- Significance of the project's potential economic, environmental, and social impacts
- Compliance with applicable federal, state, and local regulations
- Technical feasibility and timely realization of alternative renewable water supplies
- Promotion of efficient use of the alternative water supplies
- Likelihood of developing transferable information
- Capabilities of project proponents to successfully implement the project

The Department may coordinate with other agencies and organizations involved in water quality regulation and issues in addition to the Arizona Department of Environmental Quality, through a review and comment process or other means, to ensure that these agencies and organizations are aware of the proposed project and are allowed time to assess any impact the proposed project may have.

9.6.2.3 Monitoring and Assessing Project Selection

Monitoring projects may be developed in cooperation with other government agencies or educational institutions through an IGA or be initiated by the Department and funded based on the availability of equipment required and the expertise to install and monitor such equipment. Project development and selection will be based on the AMA's monitoring and assessment needs in consultation with the GUAC.

9.6.3 <u>Contract Development</u>

Each applicant receiving a favorable determination from the director is required to enter into a contractual agreement with the Department. The contract is prepared by Department staff consistent with the applicant's proposal and describes what is to be accomplished by the applicant for which reimbursement will occur.

9.6.4 <u>Contract Monitoring and Support</u>

Department staff track the progress of each contractor. Intermediate contract deliverables and review provisions are adhered to. Contract products are reviewed for consistency with contract requirements. Department staff issue payments, modify contracts as needed, and provide other legal and administrative support.

9.6.5 <u>Clearinghouse</u>

Each AMA acts as an information repository for all conservation, augmentation, and monitoring information generated from contracts they administer. In addition to any information transfers or product dissemination called for in the contracts, the Department makes all information and products generated by contracts available to anyone.

The Department's Web site also serves as an information clearinghouse and the primary public venue for dissemination of current information on the programs. Information gained through Department sponsored programs, which are deemed to be regionally, statewide, and/or nationally transferable, will be placed on the Department's Web site and updated regularly. An additional focus will be linking the Department's Web site to other pertinent Web sites. This will assist users in finding water conservation, water supply, and augmentation information from other sources.

A centralized clearinghouse could include a library of conservation and augmentation literature, detailed information on grants and contracts funded, and could provide centralized water conservation outreach activities.

9.7 FUTURE PROGRAM DIRECTION

The future of the Water Management Assistance Program will be influenced and shaped by many considerations. The next ten years will be pivotal years in the Department's effort to maintain the management plan goals of safe-yield and prevention of long-term declines in local water table levels. Key considerations in the structure of the Third Management Plan program will be:

- Program goals and objectives
- Program priorities
- Program process

9.7.1 Third Management Plan Goals and Objectives

The Water Management Assistance Program goals are described in section 9.3. These goals are legislatively derived and articulate what this program is expected to achieve, which is assisting water users in achieving their management plan conservation requirements and in developing replenishment projects. The Water Management Assistance Program goals are consistent with, and should contribute to, the AMA goals of maintaining safe-yield conditions and preventing long-term declines in local water table levels by increasing water use efficiency and studying and providing funding for increasing available water supplies. Program objectives for the Third Management Plan are also described in section 9.3. The Third Management Plan will place a greater emphasis on studying replenishment options and expanding monitoring programs to assist in meeting the unique water management problems of the Santa Cruz AMA. The Third Management Plan objectives are as follows:

- The Department, in consultation with the GUAC, will identify augmentation/replenishment, monitoring and conservation assistance projects of the highest priority order. These projects, through applications or Department initiative, will receive first funding status.

- The Department, in consultation with the GUAC, will list other priority projects and categories for technical or funding assistance. Applications in this priority category will compete with all other applications, however, preference points will be given to the priority applications.

- Provide increased levels of consideration between AMAs regarding AMA funding priorities, multi-AMA projects, information dissemination, etc.

- Increase public awareness of the importance of replenishment, monitoring and water conservation.

9.7.2 Program Priorities

Program priorities have and will continue to be an annual determination by the water using community, the GUAC, and the Department. This annual determination will provide maximum flexibility to accommodate rapidly changing technological, economic, and hydrologic conditions. This approach should consider priorities that emerge during the third management period, as well as the priorities that have been identified in the various chapters of this plan. The creation of a water district in the Santa Cruz AMA may provide a mechanism to implement the replenishment options identified through the Water Management Assistance Program. The district may have other functions that could benefit from studies and pilot programs initiated by augmentation, monitoring and conservation assistance grants. Although subject to revision during the third management period, initial program priorities include:

Replenishment priorities

- identification of areas where replenishment can occur to best maintain local water table levels and safe-yield conditions
- determination of the potential to capture excess surface water flow to replenish local portions of the Younger Alluvium of the Santa Cruz River
- investigation of the potential of transporting existing water supplies to other areas within the AMA to mitigate drought conditions and secure continuous physical availability of water

Monitoring priorities

- increased number of wells monitored for water levels
- increased number of wells equipped with continuous water level recorders
- construction of stream gage(s)
- funding for replacement/repair of non-functioning/malfunctioning totalizer meters associated with water rights required to report annual water withdrawn from wells to the Department
- potential for voluntary, fixed or mobile monitoring of exempt wells

Municipal priorities

- quantification of landscape water needs under Santa Cruz AMA demographic conditions
- existing residential retrofit and audit programs
- existing and new residential landscape water use conservation education programs
- local or statewide media campaign that will increase awareness of water supply/demand in the AMA
- investigation of potential replenishment project sites

Industrial priorities

- opportunities for direct use of effluent supplies
- further research on application rates for turf and new irrigation technologies

Agricultural priorities

- funding for improved water measurement
- investigation of new drought resistant crop varieties
- research comparing water use associated with new crop varieties compared to commonly used crop varieties
- comparison of costs associated with seed and nutrients, etc. associated with newer low water using or drought tolerate crop varieties compared to commonly used varieties

CHAPTER

10

Plan Implementation and Additional Well Spacing Criteria

10.1 INTRODUCTION

This chapter describes the process the Arizona Department of Water Resources (Department) will follow when implementing, determining compliance with, and enforcing compliance with the Third Management Plan requirements. These plan elements will be carried out in accordance with the Department's overall regulatory approach, which is described in the preface to Section II, Regulatory Programs.

As the goal of the Santa Cruz Active Management Area (AMA) is further refined, assured water supply consistency with goal criteria are developed and adopted, and water rights issues are addressed, this plan is expected to be modified. Programs may change and conservation requirements may be revised and renoticed. This chapter is in the plan for the Santa Cruz AMA to ensure that a description of the Department's approach to plan implementation is included. Regardless of the changes made to the programs contained in the plan for the Santa Cruz AMA, the Department will continue to notice water users of their conservation requirements; accept requests for variance and administrative review; provide for plan modification; require water users to properly measure, record, and report their water withdrawals and water use; audit annual water use reports; perform field inspections where water withdrawal, transportation, and use facilities are located; and enforce the provisions of this plan and the Groundwater Code (Code).

The following topics are discussed in the order listed:

- Notice of Conservation Requirements - Compliance Dates
- Variance and Administrative Review Process
- Plan Modification Procedures
- Water Use Reporting Requirements
- Monitoring and Audit Procedures
- Compliance Approach
- Well Spacing Criteria

10.2 NOTICE OF CONSERVATION REQUIREMENTS - COMPLIANCE DATES

Within 30 days of adoption of the Third Management Plan, the Department will mail written notice of the irrigation water duties and conservation requirements established in the plan to the persons required to comply with the requirements. A.R.S. § 45-566(B). The written notice will set forth the final irrigation water duty or conservation requirement that will become effective on January 1, 2010 and any intermediate conservation requirements that must be complied with prior to that time. Two years before the compliance date for an irrigation water duty or conservation requirement established in the Third Management Plan, the Department will give additional written notice of the requirement to the person required to comply. A.R.S. § 45-566(B).

A person who receives notice of an irrigation water duty or conservation requirement established in the Third Management Plan must begin complying with the requirement by the date specified in the notice, unless the person applies for and is granted a variance, as explained in section 10.3. A.R.S. § 45-566(C). The person must continue complying with the requirement until the effective date of any substitute irrigation water duty or conservation requirement established in the Third or Fourth Management Plans. If a person receives notice of a Third Management Plan irrigation water duty or conservation requirement that replaces an irrigation water duty or conservation requirement established for the person in the Second Management Plan, the person must continue complying with the Second Management Plan irrigation water duty or conservation requirement until the effective date of the Third Management Plan requirement.

The director may give written notice of a conservation requirement at any time to a person with a right or permit to withdraw, distribute, or use water withdrawn from a well or wells that were not in existence when the management plan was adopted. The person given written notice must comply with the conservation requirement not later than the compliance date specified in the notice, unless the person applies for and is granted a variance. A.R.S. § 45-571.01(B) and (C).

10.3 VARIANCE AND ADMINISTRATIVE REVIEW PROCESS

Upon receipt of a notice of a Third Management Plan irrigation water duty or conservation requirement, a person may apply for a variance from or seek administrative review of the water duty or conservation requirement. In general, a variance gives a person additional time to comply with an irrigation water duty or conservation requirement, while an administrative review can result in an adjustment to the requirement for that management period. Each of these processes is described below.

10.3.1 Variance

If a person requires additional time to comply with a new irrigation water duty or conservation requirement, the person may apply for a variance. An application for a variance must be filed within 90 days of the date of the notice of the irrigation water duty or conservation requirement given two years prior to the compliance date for the requirement. A.R.S. § 45-574(A). The director may grant a variance for up to five years upon a showing that "compelling economic circumstances" will prevent the person from complying with the new irrigation water duty or conservation requirement by the compliance date specified in the notice. A person granted a variance must continue complying with any existing irrigation water duty or conservation requirement during the variance period, unless the director establishes a schedule of intermediate water duties or conservation requirements to be reached at specified intervals during the variance period. A.R.S. § 45-574(C).

10.3.2 Administrative Review

If a person believes that an error or omission was made in calculating the person's irrigation water duty or conservation requirement, the person may request an administrative review of the irrigation water duty or conservation requirement. If granted, an administrative review can result in a permanent adjustment to the irrigation water duty or conservation requirement. An application for administrative review must be filed within 90 days of the date of the notice of the irrigation water duty or conservation requirement given within 30 days of adoption of the management plan, if the application is based on circumstances in existence as of the date of the notice. A.R.S. § 45-575(A).

At any time during the third management period, a person may seek administrative review of the person's irrigation water duty or conservation requirement based on a claim that "extraordinary circumstances not in existence as of the date of notice that was given thirty days after adoption of the management plan" justify revision of the irrigation water duty or conservation requirement. The director may revise the irrigation water duty or conservation requirement based on clear and convincing evidence that extraordinary circumstances not in existence as of the date of notice make it unreasonable to require compliance with the irrigation water duty or conservation requirement. A.R.S. § 45-575(B).

In determining whether extraordinary circumstances exist that render an irrigation water duty or conservation requirement unreasonable, the director will consider among other things whether actual conditions that came into existence after the date of notice are significantly different from those conditions in effect at the date of notice.

Examples of extraordinary circumstances may include the following situations: changes in water quality that necessitate altering water application rates for irrigation grandfathered rights; changes in technology or economics that are significantly different from the Department's projections or assumptions; and changes in federal, state, and local laws and regulations that prevent compliance with irrigation water duties or conservation requirements.

Additionally, a municipal provider that is subject to the Non-Per Capita Conservation Program (NPCCP) may seek administrative review of a conservation requirement, other than a conservation requirement for an individual user, only if the municipal provider claims at any time that "significant circumstances that did not exist when the municipal provider's application for the NPCCP was approved by the director" justify the modification. The director may modify the conservation requirement upon clear and convincing evidence that significant circumstances that did not exist when the application was approved by the director make it unreasonable to require compliance. A.R.S. § 45-575(C).

10.4 PLAN MODIFICATION PROCEDURES

At any time after the Third Management Plan is adopted, the plan may be modified pursuant to the same public hearing and comment procedures required for adoption of the plan. A.R.S. § 45-572(A). Further, the director may modify an irrigation water duty or conservation requirement established in the plan "only if the director determines that extraordinary circumstances, errors, or mistakes justify the modification." A.R.S. § 45-572(A).

Within 30 days of a modification of an irrigation water duty or conservation requirement, the Department must give written notice of the modification to the person required to comply with the modified requirement. The person may request a variance from or an administrative review of the modified irrigation water duty or conservation requirement within 90 days of the date of the notice. A.R.S. § 45-572(B) and (C).

10.5 WATER USE REPORTING REQUIREMENTS

The Code contains a number of provisions that enable the Department to acquire needed information on water use. This information is used to evaluate compliance with the Code and Department rules, permits, and management plans. The water use monitoring and reporting requirements, which are summarized below, are also designed to give water users the data needed to assess their progress in attaining conservation requirements.

10.5.1 Water Measurement

The Code requires persons withdrawing water from non-exempt wells in AMAs to measure those withdrawals using a water measuring device approved by the director. A.R.S. § 45-604. However, some small irrigation and non-irrigation users are exempt from the measuring device requirements. The Department has adopted rules requiring the use of an approved device, or a combination of devices and methods, for measuring rates and volumes of water withdrawals for the calculation of the total annual volume of water withdrawn. A.A.C. R12-15-901, *et seq.* Persons subject to the measuring device requirements must maintain the accuracy of the device within specific standards.

10.5.2 Records and Annual Reports

The Code requires most persons who own or lease a right or permit to withdraw, receive, or use water withdrawn from wells to file an Annual Water Withdrawal and Use Report with the director for each right or permit they hold. All persons required to file annual reports must maintain current and accurate records of water withdrawn, delivered, received, and used. A.R.S. § 45-632.

Persons withdrawing water from exempt wells and most non-irrigation customers of cities, towns, private water companies, and irrigation districts are exempt from record keeping and reporting requirements. Persons receiving water pursuant to a grandfathered right or a water withdrawal permit and persons assigned and noticed of individual user requirements must meet the record keeping and reporting requirements, although certain small right holders are exempted from those provisions.

10.6 MONITORING AND AUDIT PROCEDURES

The Department has the authority to determine compliance with Code, management plan, and rule requirements. This authority is described below.

10.6.1 Measuring Devices

The Department monitors compliance with the measuring device requirements, as required by A.A.C. R12-15-901, *et seq.,* through review of Annual Water Withdrawal and Use Reports, field investigations, and evaluations of energy usage. Before field visits, the Department generally contacts well owners to ask for their cooperation and presence during the inspection. Standardized procedures and equipment are used to test the accuracy of measuring devices. The Department checks a significant percentage of the wells in the Santa Cruz AMA for accuracy each year.

10.6.2 Irrigation Acreage and Water Use Monitoring

The Department monitors irrigated acreage and irrigation water use in the Santa Cruz AMA using annual reports, crop records, energy use records, aerial photography, and satellite-based remote sensing data. These procedures are also used to determine the accuracy of annual water use reports and to detect illegal irrigation. The Department investigates any potential discrepancies or violations identified using these methods.

10.6.3 Annual Report Reviews and Audits

The Department reviews all annual water withdrawal and use reports. This is the Department's primary means for determining compliance with conservation requirements, measuring requirements, and water right or permit limitations.

Each year, the Department conducts official audits of a significant number of annual reports to check the accuracy of the reports and to verify suspected problems. An audit is a detailed review by Department staff of a person's water use records. Each person audited is requested to attend the audit. Audits ensure overall compliance with the Code and the management plan for the Santa Cruz AMA.

10.6.4 Inspections

The Code allows the Department to enter property where facilities are located that are used for the withdrawal, transportation, or use of water from a well. This authority allows the Department to inspect facilities and lands subject to Code provisions and obtain data or access to records relating to the withdrawal, use, or transportation of water from a well. A.R.S. § 45-633.

The Department is generally required to give persons reasonable notice of inspections or investigations unless entry is sought solely to inspect a measuring device. Notice is not required in the rare cases in which there is reason to believe that notice would impede enforcement efforts.

10.7 COMPLIANCE APPROACH

The Department has developed a compliance program approach that includes education, assistance, and flexibility.

10.7.1 Education and Assistance

The Department informs water users of their conservation and reporting requirements as described in section 10.2 of this chapter. The Department also educates water users by explaining how the requirements were derived and how the user can achieve those requirements. This is done through advisory committees, detailed program descriptions contained in reports and issue papers, public presentations, the publication of this management plan, and individual meetings with interested users.

Annual flexibility account balance statements are sent to all affected users allowing them to monitor their compliance status. Irrigation grandfathered right holders who have exceeded the debit limits of their flex accounts or who are close to exceeding them are notified of their status and given the opportunity to reduce water usage or purchase flex credits to avoid an enforcement action. However, irrigation grandfathered right holders regulated under the Historic Cropping Program may not purchase flex credits.

Financial and technical assistance is available to water users to assist them in meeting their conservation requirements. This assistance is more fully described in Chapter 9.

10.7.2 Determination of Compliance

The mandatory conservation programs in the Third Management Plan are designed to achieve reductions in water withdrawn from wells and water use. Consequently, the persons given notice of irrigation water duties and conservation requirements established in the plan are required to comply with those irrigation water duties and conservation requirements only in those years in which they withdraw, distribute, or receive water from a well. The following two sections describe how the Department determines compliance with conservation requirements when water withdrawn from a well is used.

10.7.2.1 Maximum Annual Water Allotments and Gallons Per Capita Per Day Requirements

The Third Management Plan establishes maximum annual water allotments for irrigation grandfathered rights, turf-related facilities, and other industrial users. Municipal providers regulated under the Total GPCD Program and the Alternative Conservation Program are required to comply with gallons per capita per day (GPCD) requirements. The requirements are similar to maximum annual water allotments in that they limit the amount of water that may be used during a year to a predetermined amount. A person's compliance with a maximum annual water allotment or GPCD requirement is generally determined by comparing the total amount of water used by the person during the year with the amount of water allowed by the allotment or GPCD requirement. However, the use of water in excess of the allotment or GPCD requirement during a year does not necessarily mean that the person is out of compliance for the year. To account for weather variations and other factors that may result in the use of more water in some years than others, the Department determines compliance through the operation of a flexibility account.

Flexibility accounts are used to determine compliance for municipal providers subject to GPCD requirements, turf-related facilities, and irrigation grandfathered rights. The total water use reported by the user for the year is compared with the amount of water the user was entitled to use during the year.

Generally, if the total amount of water used during the year is less than the allotment for the year, the flexibility account is credited with the difference. If the water use exceeds the allotment, the flexibility account is debited with the difference. A user is out of compliance with its allotment or GPCD requirement in any year in which its flexibility account is debited with an amount of water that causes the account balance to exceed the maximum negative balance allowed for the use.

If an irrigation grandfathered right, turf-related facility, or municipal provider uses water during a year in an amount which causes its flexibility account to exceed its maximum negative account balance, a violation occurs but only to the extent that water withdrawn from a well is included in excess. The majority of water users in the Santa Cruz AMA withdraw water from wells along the Santa Cruz River. This water may at times be shallow water moving just below the land surface. Effluent is also discharged into the Santa Cruz River and some portion of water withdrawals in the area of discharge and downstream may be made up this source of supply. Groundwater may also be withdrawn from wells along the river. The legislature recognized this intermingling of different sources when it created the Santa Cruz AMA in 1994. Because this intermingling of separate sources combines to fill the storage capacity of the Younger Alluvium of the river, the Department considers all water withdrawn from wells, other than stored water, in determining compliance with conservation requirements in the management plans for the Santa Cruz AMA. However, should an irrigation grandfathered right, turf-related facility, or municipal provider use water from a source other than a well, such as a direct diversion of surface water flow or the direct delivery of effluent through a distribution line separate and distinct from a potable distribution system, the water withdrawn from wells would be "stacked" on top of the water from any other source. This is known as the process of "stacking."

Under the stacking process, water from all sources used by a person during a year, with certain exceptions, is counted when comparing the person's water use to the maximum annual water allotment or GPCD requirement. This process counts last the water withdrawn from a well or wells. Because water withdrawn from wells is counted last, the amount of any water used by a person in excess of its allotment or GPCD requirement will be comprised, at least partially, of water withdrawn from wells.

10.7.2.2 Specific Conservation Measures

Municipal providers regulated under the NPCCP are required to comply with specific conservation measures instead of GPCD requirements. Sand and gravel facilities and new large landscape users are required to comply with conservation measures specific to their type of use instead of maximum annual water allotments. For these municipal providers and industrial users, compliance will be determined by ascertaining whether they implemented their specific conservation measures in the manner required by the management plan rather than by comparing their water use to a volumetric allotment. They are out of compliance if they fail to implement the conservation measures in the required manner.

All industrial users, including those subject to maximum annual water allotments, are required to comply with the conservation measures established for All Industrial Users in section 6-202 of Chapter 6. These conservation requirements include general requirements to avoid waste and make efforts to recycle water. They also include more specific requirements relating to low water use landscaping, landscaping and water features in publicly-owned rights-of-way, single pass heating and cooling, and low flow plumbing fixtures. In addition to these requirements, section 6-602 of Chapter 6 requires that all new large industrial users submit a water conservation plan to the director.

10.7.3 <u>The Enforcement Process</u>

When the Department's monitoring program identifies a potential violation or when third party complaints are received about the activities of another user, an investigation is conducted to obtain the facts.

An investigation may involve a field inspection by Department staff or an audit at the Department's office after notice to the potential violator. The Department may request that the individual produce relevant records for the inspection or audit. Based on the investigation, the Department will determine whether there has been a violation and, if so, what course of action to take.

Where the violation is minor and does not require corrective action, the Department may bring the compliance action to a close with an advisory letter upon discontinuance of the violation. For more serious violations where there is reason to believe a person is violating or has violated a statute, permit, rule, or management plan provision, enforcement action will be taken by the Department.

During the first and second management periods, the Department took a non-traditional approach to enforcement. Given the recent introduction of the Code and management plans, a high level of tolerance was employed. Fines were set at low levels and probationary provisions and advisory notices were widely used. Usually, for unintentional violations of management plan requirements such as GPCD limits and maximum turf or irrigation grandfathered right allotments, the Department deferred any monetary penalties. Instead, it allowed the violator to develop or expand conservation measures designed to help the violator reduce water use. The Department felt that the long-term benefits of a properly designed and implemented conservation program, tightly structured and closely monitored, would exceed the benefits of a traditional monetary penalty program.

For a management plan violation, the violator was given the following options:

- Contest the enforcement action by requesting a hearing; or
- Pay a predetermined monetary penalty, generally based on the amount of water used in excess of the requirement; or
- Negotiate a mitigation program with the Department designed to develop or expand conservation programs intended to assist the violator in achieving future compliance.

The results of this enforcement strategy have been mixed. Some mitigation programs developed under this approach have been successful in increasing water use efficiency, while others have been less effective. In most cases, significant and sometimes disproportionate amounts of time and resources have been invested by both the violators and the Department.

The Third Management Plan approach to enforcement will exercise flexibility on a more limited scale. The arguments of "newness and complexity" will be less compelling in this management period. Previous violations will be considered in determining the appropriate compliance approach. In addition, the Department may consider new compliance approaches during the management period for Code and management plan violations. One possible provision would employ a replenishment option. This may involve storage of effluent or other water not withdrawn from a well that is designated as nonrecoverable, as defined by A.R.S. § 45-833.01. The volume replenished would compensate for the violation. A related approach may allow the purchase and extinguishment of long-term storage credits to offset a violation. The result of these approaches is a penalty that compensates for a violation and results in a positive water resource activity. If a water user anticipates a violation and informs the Department of this expectation before receiving a notice of noncompliance, the director may consider this voluntary disclosure to be a mitigating factor in determining the appropriate enforcement action.

The Department may consider a more aggressive level of compensation for certain violations as part of its forthcoming "critical area strategy." The portion of the water management goal for the Santa Cruz AMA requiring the prevention of long-term declines in local water table levels may result in more stringent compliance in these areas of the AMA. Such areas might be defined as critical areas through a management plan modification.

Additional enforcement mechanisms are generally reserved for violators not amenable to the previously mentioned approaches. They include contested hearings, cease and desist orders, and civil penalties of up to $10,000 per day for violations directly related to illegal withdrawals, transportation, or use of water. A.R.S. §§ 45-634 and 45-635.

Extremely serious cases may also be referred for criminal prosecution if persons knowingly violate or refuse to comply with the Code or with a permit, rule, or order issued or adopted under the Code.

10.8 WELL SPACING CRITERIA

The Department evaluates applications to drill new "non-exempt" wells or replacement "non-exempt" wells in new locations through general well spacing rules. A non-exempt well is a well with a capacity to pump greater than 35 gallons of water per minute. The purpose of the general well spacing rules is "to prevent unreasonably increasing damage to surrounding land or other water users from the concentration of wells." A.R.S. § 45-598(A). These general rules apply to all AMAs including Santa Cruz.

The general well spacing and well impact rules, R12-15-830, pertain to all well permits applications submitted pursuant to A.R.S. § 45-559. The statute requires such applications be approved only if the director of the Department determines that the proposed well ". . . will not unreasonably increase damage to surrounding land or other water users from the concentration of wells."

The well impact analysis required for new wells drilled pursuant to A.R.S. § 45-559 requires a hydrologic study of projected declines in water levels due to the operation of the proposed well or wells. In appropriate cases, including when the proposed well is to be located in an area of known land subsidence or poor quality water, the director may require the applicant to submit hydrologic studies or data relating to these considerations.

In addition to the general well spacing rules, the statutes require the Santa Cruz AMA to include in its management plan for the third management period "criteria for the location of new wells and replacement wells in new locations consistent with the management goal of the active management area." A.R.S. § 45-566(A)(11).

The Department's objective in including these additional well spacing criteria in the Santa Cruz AMA Third Management Plan is to avoid negative impacts from the drilling of new wells or replacement wells in new locations under safe-yield conditions and to avoid long-term declines in local water table levels. Although many are non-exempt wells requiring a notice of intention to drill or a groundwater withdrawal permit, it should be understood that certain types of wells, such as mineral exploration wells, geotechnical wells, monitor wells, and piezometers, are excluded from these well-spacing rules. These types of wells do not pump significant volumes of water and are, therefore, excluded from the well impact rules.

Any non-exempt well proposed to be drilled within the Santa Cruz AMA during the third management period must demonstrate that it will not result in long-term declines in local water table levels. Applicants are strongly encouraged to contact the Department's Hydrology Division prior to submitting an application to drill a new non-exempt well or a replacement well in a new location to discuss the information required to be included in a hydrologic study.

The Department evaluated existing hydrologic data in the preparation of the Third Management Plan for the Santa Cruz AMA. The available information is sufficient to include well spacing criteria for the AMA at this time. Exempt wells have the capacity to pump 35 gallons of water per minute or less and may pump no more than a total of 10 acre-feet per year. Exempt wells are not regulated for water conservation, are not required to measure and report withdrawals, and are not subject to the Department's well spacing criteria or the additional well spacing criteria included in this management plan.

The Department will evaluate all new wells and replacement wells in new locations based on the hydrologic impact analysis submitted by the applicant and the most recent hydrologic data for the local area. If at any time until the management plan well spacing criteria are further refined and adopted through a modification of the plan the Department determines that a proposed well will have a negative effect on the maintenance of local water table levels and safe-yield conditions, the Department may refuse to issue the permit.

10.9 WELL SPACING REQUIREMENTS

Within the Santa Cruz AMA, any person proposing to drill a new well, non-exempt well, or a non-exempt replacement well in a new location must include with the application a hydrologic study demonstrating that withdrawals from the proposed well will not result in local water tables experiencing a long-term decline.

10.10 IMPACT OF THE SANTA CRUZ AMA THIRD MANAGEMENT PLAN ON THE TUCSON AMA

The Third Management Plan for the Santa Cruz AMA must include "an evaluation of the potential impact of the plan on the Tucson active management area." A.R.S. § 45-566(A)(12). Completion of the Department's hydrologic model for the Santa Cruz AMA will provide an understanding of potential impacts. Potential impacts are likely to evolve during the third management period as augmentation, recharge and distribution projects are developed, constructed, and utilized. Well spacing and local water management are likely to encourage higher water table levels in the Santa Cruz AMA, which could also benefit the Tucson AMA. One potential augmentation project which would capture and store water in the Santa Cruz AMA that might otherwise have entered the Tucson AMA as flood flow may reduce flood flow into the Tucson AMA. (Chapter 8 discusses potential augmentation strategies.) However, this idea, along with all augmentation strategies, will need to be developed further during the third management period prior to construction and implementation of any projects. Many legal issues would need to be resolved before a project could be constructed to retain flood flow. Because demand is increasing as growth occurs in the Santa Cruz AMA, increased efficiency associated with the implementation of conservation measures would reduce any possible impact on the Tucson AMA compared to growth at less efficient use rates. The Tucson AMA may be positively impacted by the Department's continuing negotiations with Mexico to secure effluent flow to the NIWWTP. The role of the Department and the Santa Cruz AMA area director in the facilities planning process creates the potential for the continuation of the availability of this supply. The creation of a water district or other entity in the Santa Cruz AMA may stabilize the water resource conditions within the Santa Cruz AMA.

SECTION

III

Future Conditions and Directions

Preface

Sections I and II have described water resource conditions within the Santa Cruz Active Management Area (AMA) and the regulatory programs designed to cause efficient use of water and promote the utilization of effluent and other alternative water supplies. The Arizona Department of Water Resources' (Department) regulatory program for the third management period, described in Section II, represents the first management strategy specific to the Santa Cruz AMA and its management goals of maintaining safe-yield and preventing long-term declines in local water table levels.

Section III describes projected future conditions within the Santa Cruz AMA, as well as the directions the Department proposes to take in developing additional water management programs during the third management period.

Potential future water supply and demand conditions are described in Chapter 11. The Department's review of supply and demand conditions is designed to illustrate a range of supply and demand possibilities for consideration as we develop our management programs.

Chapter 12 describes some options for the future looking toward exploration of potential sources of supply, examining augmentation strategies, limiting impacts of new wells, and requiring efficient use of water to help maintain the AMA goals into the future. Chapter 12 summarizes existing water management problems, identifies the obstacles to maintaining safe-yield and local water table levels, and describes the actions that the Department, AMA water providers, and water users can take during the third management period and beyond.

CHAPTER

11

Water Supply and Demand Analysis

11.1 INTRODUCTION

The Arizona Department of Water Resources (Department) uses detailed, AMA-wide water budgets as a tool to determine the balance between water demands and supplies. Water budgets are one method of estimating the current and projected status of an Active Management Area (AMA) relative to the management goal of safe-yield. Because these budgets address conditions on an AMA-wide scale, they are not useful in determining the long-term effect of pumping and recharge on local water table levels. Continued monitoring of local water levels and the further development of the hydrologic model of the Santa Cruz AMA will provide information useful in developing management strategies for local water tables. This chapter discusses the safe-yield portion of the Santa Cruz AMA goal.

Long-term averages of natural recharge to the aquifer from precipitation and surface flow are usually incorporated into AMA-wide water budgets. These figures are useful in AMAs with sufficient groundwater storage that is not significantly affected by variations in surface water flow. They are also useful in instances where timely data is not collected and where measurements are not made. However, due to the extreme variability in precipitation and surface flow in the Santa Cruz AMA, net natural recharge in the AMA varies not only from year to year but from season to season. See Chapter 2. Water budgets that use long-term averages for natural supply components do not illustrate the seasonality and variability in some components of net natural recharge, which is an important factor to consider in water management in the Santa Cruz AMA. Therefore, the use of long-term averages, in some instances, is insufficient as a water management tool for the Santa Cruz AMA.

The Santa Cruz AMA is particularly susceptible to drought conditions since a firm backup or alternative supply to water withdrawn from wells in the Younger Alluvium is not readily available. In years where there is low rainfall and little surface flow along the Santa Cruz River, water in storage is depleted. In order to prepare for periods of drought, augmentation of the water supply combined with improved distribution and efficient use of current supplies will be needed as municipal and industrial water demand continues to increase. A number of factors can affect the development and implementation of augmentation projects. These are described in detail in Chapter 8. When demands increase to the point where supplies are fully utilized, augmentation will be needed to meet the demands of additional growth even during non-drought periods in order to maintain safe-yield conditions.

Two methods of projecting water demand are included in this chapter. The Current Use Rate Scenario uses the average demand for the three water use sectors from 1992-1995 to project demand. The Increased Efficiency Scenario projects municipal water demand based on an increased level of efficiency. These scenarios provide a general idea of the increase in water demand that might occur by 2025, and the reduction in demand that could be realized if large municipal water providers implement conservation measures.

Water is a physical resource and as such can be tracked and understood in physical terms. However, water management has historically been tied to legal accounting mechanisms for water rather than based exclusively on the hydrology. Legal mechanisms for water accounting address issues such as internationally shared effluent, adjudication of surface water rights, and encouraging the use of remediated groundwater. However, these inconsistencies between physical reality and legal accounting complicate discussion of water supplies.

In the Santa Cruz AMA, effluent discharged from the Nogales International Wastewater Treatment Plant (NIWWTP) is not delivered through a distribution system for direct use. The effluent, surface water, and groundwater are commingled in the Younger Alluvium along a reach of the Santa Cruz River downstream from the NIWWTP. Because NIWWTP effluent discharge stabilizes water tables in the Younger Alluvium and contributes to the AMA's safe-yield balance, it is important to include it as a water supply in an evaluation of supplies versus demands.

11.2 HISTORIC DEMANDS

Chapter 3 of this plan provides information on historic demand in the municipal, industrial, and agricultural demand sectors from 1985 through 1997. Demand components for these sectors are based on water withdrawals and use reported to the Department. Although limited information is available on exempt well pumpage, it is included in these budgets as an estimate for stock watering and domestic exempt uses, based on the number of registrations on file. The Department has no monitoring and reporting authority over water withdrawals from exempt wells. Other demand components included are underflow exiting the AMA and riparian demand.

11.3 PROJECTED DEMANDS

Two projected demand scenarios have been developed by the Department to analyze possible future water demand and supply conditions in the Santa Cruz AMA. The projected demand scenarios are as follows:

- **Current Use Rate:** Assumes that recent average municipal, agricultural, and industrial water use practices continue through the year 2025. The total demands as calculated in this scenario are shown in Table 11-1.

- **Increased Efficiency:** Assumes that municipal demand levels are reduced to meet Third Management Plan conservation requirements by 2010 and these reduced rates continue through the year 2025. The total demands as calculated in this scenario are shown in Table 11-2.

The following general assumptions stay constant for both water budget scenarios:

- The AMA population projections are based on Arizona Department of Economic Security (ADES) projections published in 1997.

- The natural system demand estimates are derived from Table 3-9. Although water demand associated with riparian areas (phreatophytes) could increase after a series of wet years and could be reduced as riparian areas are lost in some areas during dry periods, riparian demand estimates are held constant for each projected year in both budgets due to the difficulty in projecting riparian demand increases or decreases under wet or dry conditions. Subflow leaving the AMA is also held constant. Although this estimate may vary from year to year and season to season, the variation may not be significant. Additional development of the Department's hydrologic model may result in an adjustment to the figure used for subflow out of the AMA.

- Exempt well demand is estimated based on the assumption that each registered well withdraws 0.5 acre-feet per year. Exempt wells used for domestic purposes are projected to increase at the 1994-1998 average rate of 32 new well registrations per year. Exempt wells used for stock watering are projected to increase at the 1994-1998 average rate of four new well registrations per year.

- Active agricultural acreage in the Santa Cruz AMA is reduced by 1,000 acre-feet to account for the sever and transfer of a portion of the water rights associated with Rio Rico Properties. No further declines in agricultural demand are projected.

- Industrial water use projections are proportional to the population growth rate projected for the Santa Cruz AMA.

Specific demand assumptions for each sector are described in the following sections.

11.3.1 Agricultural Demand Assumptions

Total agricultural water demand was 8,960 acre-feet in 1985; 11,603 acre-feet in 1990; and 12,884 acre-feet in 1995. Water use between 1990 and 1996 ranged from a low of 8,122 acre-feet in 1993 to a high of 15,913 acre-feet in 1994, although the pattern reflects numerous fluctuations instead of a consistent rise in water use, as shown in Figure 3-2. Water use by the largest agricultural user, Rio Rico Properties, influences the trend in agricultural use.

Agricultural water demand is a function of the total acreage which can legally be irrigated, the land actually cultivated in a given year (the crop-acreage ratio), the efficiency of water use, the average consumptive use of crops, and any lost and unaccounted for water. There are agricultural lands within the Santa Cruz AMA which have both an Irrigation Grandfathered Right (IGFR), regulated under the Groundwater Code, and a surface water right claim, subject to adjudication under surface water law. This situation is referred to as a "dual right" because the IGFR and surface water claim pertain to the same acreage. Under surface water law, agricultural uses of surface water that are discontinued for a period of time are susceptible to forfeiture or abandonment. In order to avoid the possibility of losing their claims to surface water, high volumes of water are sometimes used. These high use years may not coincide with economic factors which favor higher agricultural production or years of low precipitation. More information on agricultural water use characteristics and projections is contained in chapters 3 and 4.

The Department has not collected information on irrigated acres on a regular basis in the Santa Cruz AMA. There are about 5,300 acres of farmland within the AMA that have an IGFR. In 1994, the Department conducted a survey of farms which revealed that roughly 2,100 acres of this total irrigable acreage were cultivated in the AMA that year. Most of this farmland is anticipated to remain active throughout the third management period and afterwards. The surface water rights claim associated with about 200 acres of IGFR farmland, amounting to about 1,000 acre-feet of water demand, were severed and transferred by Rio Rico Properties in 1996 to support municipal growth.

The 1992-1995 average water use by the agricultural sector was 11,300 acre-feet. Agricultural demand was reduced to 10,300 acre-feet in the year 1997, which first appears in the projected year 2000. This reflects the Rio Rico sever and transfer. While some individual right holders may convert their rights to support residential growth, projected agricultural demand is not reduced below 10,300 acre-feet. However, discontinuing demand in one sector in order to increase demand in another sector is one tool that can be used to help maintain safe-yield conditions.

11.3.2 Municipal Demand Assumptions

Municipal demand includes potable and nonpotable water use by AMA water providers. Nonpotable water is delivered through a distribution system distinct from the potable distribution system, usually for the purposes of landscape or turf-related watering. Water demand associated with exempt domestic wells is estimated due to the lack of information on actual demand. Population and per capita water consumption are the primary factors that influence municipal demand.

11.3.2.1 Population

Executive Order 95-10 requires state agencies to utilize the population projections approved by the ADES. The ADES prepares population projections for the state every five years. These projections are disaggregated by the counties for local jurisdictions. The Department further disaggregates the ADES projections into subbasin and AMA boundaries statewide. Because projections must be consistent with the state total, many communities in the state are assigned lower projections than the growth that the local community actually expects will occur. For the last several years, the ADES projections have proven low compared to observed growth. This will probably be the case with the ADES projections used by the

Department in this chapter, which were prepared in 1997. Observed growth may be considerably higher than the population projections used in the water budgets contained in this chapter.

Based on the information collected by the Department in Annual Water Withdrawal and Use reports, it appears that recent growth rates in the Santa Cruz AMA are exceeding the rates of growth used by ADES in 1997 to calculate projections. Since the population projections are only updated once every five years, changes in rates of growth within the five-year time span may render the projections out of date. Moreover, differences in the projection methodologies used for the state, county, and local level may result in over or underestimation of the population for AMAs. For example, if the population projection for a city or town is high, but the projection for unincorporated areas of the county is low, then the total projection for the AMA may be low. The projections for municipal providers in unincorporated areas may also be low. In order to ensure the most accurate projections possible, building completions and certificates of occupancy in all areas within the AMA must be closely tracked and good records must be maintained since this is the main source of data used by ADES to develop population projections for the state. Appendices 11A and 11B show how population projections were disaggregated by the Department for water providers in the Santa Cruz AMA.

If the population grows at a higher rate than is indicated in the projections, the water demand will be higher. Also, if per capita water use is greater than the rate used in the projections, demand will be higher. The opposite is true if the population grows at a slower rate than projected and if demand is lower than anticipated. These figures provide an estimate of demand at current and more conserving use rates, using the official population projections as prepared by ADES, in order to develop future demand scenarios for planning purposes. As new projections are developed and approved, these projections will change.

11.3.2.2 Water Use

The same set of population projections was used to calculate demand projections in each scenario. For more detail on municipal water use trends and Third Management Plan conservation requirements, please refer to chapters 3 (Water Use Characteristics and Trends) and 5 (Municipal Conservation Program).

11.3.2.2.1 Current Use Rate Scenario

The 1992 through 1995 average gallons per capita per day (GPCD) rates for large providers and for small providers as a whole were used to project demand for the current scenario. Note that these projections do not assume any additional water savings achieved through the implementation of water conservation measures or the use of low water use plumbing fixtures such as showerheads, faucets, and low-flow toilets. However, federal and state laws require the installation of low water using plumbing fixtures in new homes. Because low flow plumbing fixtures are now required, water demand in new homes should be lower, on a per capita basis, than water demand in existing homes.

11.3.2.2.2 Increased Efficiency Scenario

In the increased efficiency or conservation scenario, large municipal providers are assumed to take the steps necessary to maintain the existing residential GPCD requirements through the year 2025. In addition, all new residential growth after the year 2000 is assumed to use water efficiently, consistent with the models for new interior and exterior residential water use described in Chapter 5. The non-residential GPCD of each municipal provider is assumed to remain at the non-residential GPCD component requirement listed in Appendix 5D of this plan. Lost and unaccounted for water is held at the 1992-1995 average rate for each large municipal provider but is assumed not to exceed the 10 percent maximum for distribution system efficiency contained in the management plan. As in the base scenario, the 1992-1995 average GPCD rate was used to project small provider water demand through the year 2025 with no reduction.

11.3.3 Industrial Demand Assumptions

Industrial demand includes all water withdrawn pursuant to non-irrigation grandfathered rights and groundwater withdrawal permits. More information on industrial water use characteristics, trends, and specific conservation requirements for each industrial subsector is contained in chapters 3 and 6. The ratio of total industrial demand to population was calculated for the sum of demand and population for 1992 through 1995. This ratio was multiplied by the population projections for the AMA to project industrial demand. The same methodology for calculating industrial demand is used in each projected demand scenario.

11.3.4 Riparian Demand

Phreatophyte evapotranspiration associated with the riparian habitat is the largest water demand in the Santa Cruz AMA. Based on the methodology described in Chapter 3, it was estimated that the volume of riparian evapotranspiration losses is about 25,800 acre-feet per year. This estimate includes riparian areas along the Santa Cruz River in Nogales Wash and along Sonoita Creek and Sopori Wash.

The volume of phreatophyte evapotranspiration is held constant in the water budgets in this chapter. While the Department acknowledges that this volume is subject to change with years of maximum or minimum supply, there is limited data available to project phreatophyte consumption.

TABLE 11-1
CURRENT USE RATE DEMAND SCENARIO
SANTA CRUZ ACTIVE MANAGEMENT AREA (Acre-Feet)

	92-95 Avg.	2000	2005	2010	2015	2020	2025
Municipal Demand	6,300	7,300	8,100	8,800	9,700	10,500	11,400
Agricultural Demand	11,300	10,300	10,300	10,300	10,300	10,300	10,300
Industrial Demand	1,300	1,500	1,700	1,800	2,000	2,200	2,400
Exempt Well Demand	500	500	600	700	800	900	1,000
Riparian Demand	25,800	25,800	25,800	25,800	25,800	25,800	25,800
Underflow Leaving AMA[1]	8,700	8,700	8,700	8,700	8,700	8,700	8,700
Total Demand	**53,900**	**54,100**	**55,200**	**56,100**	**57,300**	**58,400**	**59,600**

[1] 8,700 is used in the Department's hydrologic model. In low supply years, this may be a little less, and in high supply years it might be a little more. This figure may be adjusted as development of the hydrologic model continues.

11.3.5 AMA Outflow

Estimated underflow exiting the Santa Cruz AMA into the Tucson AMA is about 8,700 acre-feet per year. See Chapter 3. Underflow, like the other natural system components included in the Santa Cruz AMA budgets, is subject to seasonal and annual fluctuations. In addition, increased demand associated with future development may have an effect on the volume of underflow leaving the AMA.

TABLE 11-2
CONSERVATION DEMAND SCENARIO
SANTA CRUZ ACTIVE MANAGEMENT AREA (Acre-Feet)

	92-95 Avg.	2000	2005	2010	2015	2020	2025
Municipal Demand	6,300	7,000	7,600	8,200	8,900	9,600	10,300
Agricultural Demand	11,300	10,300	10,300	10,300	10,300	10,300	10,300
Industrial Demand	1,300	1,500	1,700	1,800	2,000	2,200	2,400
Exempt Well Demand	500	500	600	700	800	900	1,000
Riparian Demand	25,800	25,800	25,800	25,800	25,800	25,800	25,800
Underflow Leaving AMA[1]	8,700	8,700	8,700	8,700	8,700	8,700	8,700
Total Demand	**53,900**	**53,800**	**54,700**	**55,500**	**56,500**	**57,500**	**58,500**

[1] 8,700 is used in the Department's hydrologic model. In low supply years, this may be a little less, and in high supply years it might be a little more. This figure may be adjusted as development of the hydrologic model continues.

11.4 SUPPLY RANGES

11.4.1 Net Natural Recharge

Natural recharge components include: (1) main channel natural flow and (2) mountain front and tributary natural recharge. An estimated range for each of these components is presented in Table 2-2. Chapter 2 also contains information on the data sources for these ranges. The range in estimates of main channel natural flow are between 1,300 acre-feet and 88,600 acre-feet per year. The range in estimates for major tributary recharge is between 5,200 and 41,300 acre-feet per year. For the analysis included in this chapter, the 10th and 90th percentiles in the range of main channel natural flow and major tributary recharge were selected from a frequency analysis. Ninety percent of the time supplies greater than the minimum shown in Table 11-3 will occur. However, this also means that in about one year out of every 10 minimum supply conditions may be realized. Maximum supply conditions were also limited based on a percentile, where the maximum supply volume shown in Table 11-3 might only occur in one year out of every 10.

Mountain front and minor tributary recharge is estimated by Osterkamp to be about 11,400 acre-feet per year. This figure may be adjusted as work on the model continues.

11.4.2 Active Management Area Inflow

Water that flows beneath the land surface (underflow) enters the Santa Cruz AMA at the International Border at two general locations, along the Santa Cruz River and west of the City of Nogales. Underflow estimates range from about 100 acre-feet to 500 acre-feet per year along the Santa Cruz River and from about 120 acre-feet to 600 acre-feet annually west of the City from the Nogales Wash. In addition, inflow from Sonoita Creek is estimated at between 120 to 600 acre-feet per year. More details on these ranges are included in Chapter 2 of this plan. Consequently, total average underflow entering the Santa Cruz AMA ranges from about 340 to about 1,700 acre-feet per year.

TABLE 11-3
MAXIMUM AND MINIMUM WATER SUPPLY
SANTA CRUZ ACTIVE MANAGEMENT AREA
(Figures Rounded to Nearest 100 Acre-Feet)

COMPONENT	RANGE IN ACRE-FEET
INFLOWS	
RECHARGE	
Main Channel & Major Tributary Natural Flow (10th and 90th Percentiles)	8,400 - 106,300
Main Channel Effluent	15,600 - 19,900
Mountain Front and Minor Tributary	11,400
Incidental (Agricultural and Industrial)	3,900 - 3,600
Total Recharge	**39,000 - 141,500**
UNDERFLOW (estimated)	
Santa Cruz River at Mexico/US Border	100 - 500
West of Nogales Mexico/US Border	200 - 1,200
Total Underflow	**300 - 1,700**
TOTAL INFLOWS	**39,600 - 142,900**

11.4.3 Incidental Recharge

Incidental recharge is the amount of water which percolates down to the water table associated with the use of water. Incidental recharge occurs when agricultural lands are irrigated and can occur when water is applied to turf-related facilities for turf-related watering. Incidental recharge also occurs when water is released to the Santa Cruz River after being treated at the NIWWTP.

11.4.3.1 Incidental Recharge from Agricultural and Industrial Uses

Excess agricultural irrigation is a substantial source of incidental recharge. Industrial water users produce a much smaller amount. The range in agricultural and industrial incidental recharge in the Santa Cruz AMA depends on the total demand of the sector in any given year. For the agricultural sector, the Department has used an assumption that about 34 percent of the water applied to farmland is recharged to the aquifer. However, as agricultural water users increase their water use efficiency, less water will be incidentally recharged. This water quickly percolates to the water table when demand occurs in portions of the Younger Alluvium due to the shallow depth to water and the high transmissivity of the aquifer in some locations.

An incidental recharge factor of 5 percent has been assigned to all industrial water use. The Department assumes that no incidental recharge occurs as a result of municipal water use. Table 11-4 shows the range in incidental recharge factors used for the Santa Cruz AMA.

TABLE 11-4
INCIDENTAL RECHARGE ASSUMPTIONS USED FOR WATER BUDGETS
SANTA CRUZ ACTIVE MANAGEMENT AREA

Rate Applied to Source of Recharge	Source of Incidental Recharge
0%	Municipal demand
34%	Agricultural demand
5%	Industrial demand

11.4.3.2 Incidental Recharge of Effluent

Effluent discharged to the Santa Cruz River between 1992 and 1995 ranged between 14,740 and 16,721 acre-feet per year. The consulting group Camp, Dresser, & MeKee (CDM) developed a projection of the estimated reduction in inflow into sewer lines due to system improvements. Currently, cracks in the sewer lines allow water to infiltrate into the sewer system that makes its way to the NIWWTP. Based on CDM's work, the Department has estimated that a 20 percent reduction in the volume of water filtering into the sewer lines will occur due to system improvements. This calculation is described in detail in Appendix 11C.

NIWWTP effluent discharge attributable to wastewater flow from Sonora was not projected to increase beyond the level indicated in the year 2005, under the assumption that additional effluent generated would be recharged within the Los Alisos groundwater basin located exclusively within Sonora. NIWWTP effluent discharge attributable to wastewater from Arizona is projected to increase without any limitations through the year 2025. It is possible that future agreements with Mexico may allow for an increase in the volume of effluent coming from Sonora, however, such an assumption was not included in the analysis in this chapter.

11.5 RESULTS OF WATER SUPPLY AND DEMAND ANALYSES

Two water demand scenarios were developed to illustrate possible water demand conditions in the Santa Cruz AMA. Based on these calculations, if growth occurs as the ADES population projections indicate, the water demand in the AMA should increase from the current use of about 56,000 acre-feet. If water is used efficiently, projected water demand could be near 59,000 acre-feet in the year 2025. If current water use practices continue, demand in the year 2025 could be 60,000 acre-feet or more. A major factor impacting future demand will be whether riparian areas in the AMA expand, contract, or remain constant.

Table 11-5 below compares current and projected demand to the minimum and maximum supply conditions. The challenge facing the Santa Cruz AMA now and in the future will be to manage water demands and supplies such that on a long-term average basis, supplies are available to equal demands in any given year. This means that between 59,000 and 60,000 acre-feet of water supply will need to be available, on a renewable basis, to maintain safe-yield conditions through the year 2025.

In years where only minimum renewable supplies are available, the AMA's water users would need to augment nearly 21,000 acre-feet in order to maintain safe-yield conditions in that year. In years where surplus supply conditions exist, the AMA aquifers may be recharged to a significant degree, although much of the surplus supply would be moving too quickly to percolate into the aquifer and would move through the AMA and on into the Tucson and perhaps Pinal AMAs.

TABLE 11-5
DEMAND AND SUPPLY ANALYSIS
SANTA CRUZ ACTIVE MANAGEMENT AREA

	Volume of Water (acre-feet)
Demand Range	56,000 - 62,000
Minimum Supply	39,000
Maximum Supply	143,000
Safe-yield Volume	59,000 - 60,000

It is important to note that fluctuations in seasonal demands and supplies can impact water in storage and the storage capacity of local portions of the aquifer. Further analysis of the change in storage capacity on a seasonal basis would provide valuable information useful in making water management decisions in the Santa Cruz AMA.

It should also be noted that minimum supply conditions may occur in a series of years resulting in a reduction in water in storage and an increase in storage capacity. When a year of maximum or increased water supply occurs, storage capacity is filled to the degree that infiltration can occur. While dry years often occur in a series, a series of wet years does not necessarily result in considerably more recharge than a single wet year. Once the available storage capacity is filled, any more water flowing into the AMA would not recharge but would instead flow out of the AMA. Moreover, unless additional storage capacity is created, either through continued pumping during drought conditions or through physical changes to the aquifer system through augmentation efforts, the occurrence of a wet year will not necessarily result in a significant increase in the volume of water in storage. Additionally, since the rate at which high surface flow moves through the AMA is much more rapid than the rate of percolation unless the water flow that occurs in a wet year is slowed, much of the flow during a wet year will pass through the AMA without percolating into the aquifer.

11.6 ANALYSIS AND DISCUSSION

11.6.1 Safe-Yield Concepts

Safe-yield is an AMA-wide balance between water entering and leaving the aquifer on an annual basis. This includes water which is added to the hydrologic system through natural or incidental recharge and water which flows out of the system naturally and water withdrawals and uses for municipal, agricultural, and industrial purposes. Whether or not safe-yield conditions are maintained in the Santa Cruz AMA will depend on increases in demand versus augmentation measures to compensate for additional growth and seasonal and annual fluctuations in water supplies. An efficient and accurate assessment of the status of the AMA relative to safe-yield will be assisted through continued hydrologic data collection and analysis on at least a seasonal basis. More frequent data collection may provide more clues to understanding the complex hydrology of the Santa Cruz AMA.

Because the water table in the Younger Alluvium of the Santa Cruz River is strongly affected by localized water recharge and withdrawals, managing for safe-yield AMA-wide does not ensure that all subareas of the AMA will be in balance. Declines in local water table levels can result in increased pumping costs, water quality degradation and loss of the amenity of riparian vegetation and associated wildlife. If minimum supply conditions persist for very long, much of the riparian growth may suffer and possibly be lost. This would result in a decrease in the volume of riparian demand (from evapotranspiration) listed in Table 11-3. Augmentation and recharge activities may stabilize local water table levels and provide a backup supply for water users during droughts.

Not all of the excess water available during wet years will recharge the aquifer. Because wet years usually include several flood flows, much of the water moves through the AMA quicker than it can infiltrate. It is possible that only a portion of the excess flow that occurs during surplus conditions actually could recharge the aquifers, assuming that water withdrawals had created storage capacity that could be filled. Wet years occurred during the 1950s which contributed an estimated 30,000 to 40,000 acre-feet of recharge based on several extremely dry years where water withdrawals created storage capacity followed by wet conditions.

Additional water management options for the Santa Cruz AMA will be developed during the third management period. Some of these may be included as a modification of this plan. Augmentation and water distribution activities may be performed by entities such as a water district. The combination of the Department's regulatory and assistance programs and the distribution, negotiation and funding capabilities of a water district or other entity will help to ensure that water continues to be available to the AMA's water users over the long-term.

The Department has begun to develop a hydrologic model of the Santa Cruz AMA, has been involved in negotiations with Mexican officials over binational water resource issues, and has worked closely with the local community to improve the understanding of how water moves through the AMA. In addition, water right holders have become interested in resolving the many dual water rights in the AMA and in pursuing legislation to create more tools to augment, preserve, distribute, and manage water supplies in the AMA. The information contained in this chapter includes estimates of projected water conditions in the Santa Cruz AMA under current and conserving rates of demand, as well as maximum and minimum supply ranges. Although this information is not presented in a water budget due to the variability of supply both seasonally and on an annual basis, it does provide guidance toward addressing the challenge of ensuring continued availability of water to meet demands and maintaining the AMA goals into the future.

11.6.3 Variation in Conditions

Projections of future water supply conditions in the Santa Cruz AMA are subject to a number of substantial variables which could have significant impacts on the maintenance of AMA goals.

- The City of Nogales relies on groundwater pumped from the Potrero Creek aquifer and the Younger Alluvial aquifer. The long-term future of the Potrero Creek aquifer could be affected by water quality and groundwater storage conditions.

- Roughly two-thirds of the effluent generated at the NIWWTP originates in Sonora. Effluent discharged to the Santa Cruz River would be reduced if Sonora were to discontinue or reduce the volume of influent sent to the NIWWTP.

- At some point in time higher standards of effluent treatment may be required to assure good quality water is available to those utilizing the water for human consumption below the NIWWTP or in areas where treated effluent is recharged.

- It is likely that population growth within the AMA will be higher than the projections indicate. The location where the growth occurs could complicate the development of water augmentation and distribution strategies. Related to this is the question of whether additional sever and transfers will occur to support certificates or designations of assured water supply. This could affect agricultural demand as well as municipal demand.

- The variability in seasonal and annual surface water flow is another challenge to water management strategy. This will continue to be a concern upstream from the NIWWTP unless augmentation occurs in this area of the AMA.

11.7 CONCLUSIONS

Managing the Santa Cruz AMA for safe-yield is challenging due to a number of factors. First, seasonal and annual surface water flow and mountain front and tributary recharge are unpredictable and highly variable. Man-made reservoirs are either of insufficient size, are not utilized, or do not exist to a degree that would allow for an adequate backup supply during drought periods to maintain the AMA goals and provide a continuous availability for current and committed water demands. Second, effluent generated in Mexico is not a secure source of supply, and future water management activities in Nogales, Sonora could either positively or negatively affect water supplies in the Santa Cruz AMA. Third, increases in demand associated with growth may be more rapid than anticipated resulting in the need for augmentation, recharge, and other efforts to occur sooner.

The hydrologic model being developed by the Department will be an important tool to improve the understanding of the hydrologic system in the Santa Cruz AMA and evaluating the possible impacts of water demand and supply trends. Continuing data collection and analysis are likely to result in improved estimates of some of the natural water demand and supply figures contained in chapters 2, 3, and 11 of this plan.

With additional hydrologic data, funding, and cooperation with the Santa Cruz AMA community and with Mexican officials to define and implement effective water resource management options for the region, the Department will be better equipped to improve water resource management in the AMA.

APPENDIX 11A
DISAGGREGATION OF POPULATION PROJECTIONS

Benched to 1997 POPTAC projections

Year	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
Nogales	14398	18026	18975	20129	21079	22029	22979	23929	24879
Rio Rico	1729	3864	6737	9150	11707	14407	17305	20434	23699
Valle Verde	1680	2543	2734	2859	2984	3109	3234	3359	3484
Citizens - Tubac	798	730	858	902	932	962	992	1022	1052
Santa Cruz County small providers	1015	1183	1272	1307	1342	1377	1412	1447	1482
Provider Total	**19620**	**26346**	**30576**	**34347**	**38044**	**41884**	**45922**	**50191**	**54596**
Exempt Wells -whole AMA	370	468	560	610	660	710	760	810	860
Avg. # of New Exempt Wells/Yr 85-95	19								
Exempt Well Registrations*.75=OCC. HU	278	351	420	458	495	533	570	608	645
AMA Exempt Pop = line above*3.5ppoh	971	1229	1470	1601	1733	1864	1995	2126	2258
Nogales CCD exempt well pop.		973	1175	1084	1067	1048	1030	1012	994
SC Total (ADES Nogales CCD)		**27406**	**31548**	**35431**	**39110**	**42932**	**46952**	**51203**	**55589**
Lakewood Water Company	627	888	877	1002	1127	1252	1377	1502	1627
Pima County exempt well population		256	295	517	666	816	965	1114	1264
Pima Total		1144	1172	1519	1793	2068	2342	2616	2891
Total AMA DES		***28550***	***32721***	***36950***	***40903***	***45000***	***49294***	***53819***	***58480***

+ Nogales grows @ 190 people per year through 2025 = growth rate 90-95.
++ Rio Rico grows @ remainder of Nogales CCD projection after exempts, smalls, Valle Verde, Tubac and Nogales come out.
+++ Valle Verde grows @ 25 people per year through 2025 = roughly growth rate average 95-96
++++ Citizens-Tubac grows @ 6 people per year from 2000 forward (avg. growth rate 85-95), and prorates 2000 projection back to 1996 service area pop.
+++++ Lakewood; 1990 and 1995 population from Annual Water Use Report, projections = 25 people every yr. (based on '85 - '95 growth)
++++++ Smalls from small provider database, minus Lakewood and Tubac through 1996, 1997 on = average growth from 95-96 (7/year).
* 1990 large provider numbers from ADWR disaggregation of 1990 Census data onto service area boundaries.
** 1985-1996 = actual data reported by large and small providers, plus wells in wells data base for exempts.
*** AMA exempts = actual # wells from ADWR database*.75 occ rate * 3.5 ppoh through 1997; proj. = 20 wells/year based on 85-95 growth / 2 (10 wells per year AMA-wide).
**** Pima exempts = DES Pima projection - Lakewood projection (from 2000 forward).
***** Nogales CCD exempts = AMA exempts - Pima exempts.

APPENDIX 11B
PROJECTED DEMAND AND EFFLUENT SUPPLIES

POPULATION	**92-95 AVE**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
Nogales	18,698	20,129	21,079	22,029	22,979	23,929	24,879
Rio Rico	5,846	9,150	11,707	14,407	17,305	20,434	23,699
Valle Verde	2,643	2,859	2,984	3,109	3,234	3,359	3,484
Tubac	811	902	932	962	992	1,022	1,052
Smalls	1,252	1,307	1,342	1,377	1,412	1,447	1,482
Exempts	1,402	1,601	1,733	1,864	1,995	2,126	2,258
Lakewood	882	1,002	1,127	1,252	1,377	1,502	1,627
MEXICO	186,216	213,784	247,834	283,147	320,356		
TOTAL AMA POPULATION	31,535	36,950	40,904	45,000	49,294	53,819	58,481
GPCD - CURRENT RATE	**92-95 AVE**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
Nogales	202	202	202	202	202	202	202
Rio Rico	172	172	172	172	172	172	172
Valle Verde	105	105	105	105	105	105	105
Tubac	253	253	253	253	253	253	253
Smalls	163	163	163	163	163	163	163
Exempts	188	188	188	188	188	188	188
GPCD - CONSERVING RATE	**92-95 AVE**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
Nogales	202	199	196	193	192	191	191
Rio Rico	172	157	151	148	146	145	144
Valle Verde	105	121	121	121	121	121	121
Tubac	253	220	212	205	203	202	201
Smalls	163	163	163	163	163	163	163
Exempts	188	188	188	188	188	188	188
DEMAND - CURRENT RATE	**92-95 AVE**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
Nogales	4,231	4,555	4,770	4,984	5,199	5,414	5,629
Rio Rico	1,126	1,763	2,256	2,776	3,334	3,937	4,566
Valle Verde	311	336	351	366	380	395	410
Tubac	230	256	264	273	281	290	298
Smalls	390	422	451	480	509	538	568
Exempts	295	337	365	393	420	448	476
TOTAL	6,583	7,668	8,456	9,271	10,124	11,022	11,946
DEMAND - CONSERVING RATE	**92-95 AVE**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
Nogales	4,231	4,487	4,628	4,762	4,942	5,120	5,323
Rio Rico	1,126	1,609	1,980	2,388	2,830	3,319	3,823
Valle Verde	311	388	404	421	438	455	472
Tubac	230	222	221	221	226	231	237
Smalls	390	422	451	480	509	538	568
Exempts	295	337	365	393	420	448	476
TOTAL	6,583	7,465	8,050	8,666	9,365	10,111	10,898

APPENDIX 11B *(continued)*
PROJECTED DEMAND AND EFFLUENT SUPPLIES

DEMAND	**92-95 AVE**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
INDUSTRIAL	1,284	1,504	1,665	1,832	2,007	2,191	2,381
AGRICULTURAL	11,339	10,339	10,339	10,339	10,339	10,339	10,339
NON-DOMESTIC EXEMPT WELLS							
Stock exempt wells	322	352	382	412	442	472	502
Exempt stock demand	161	176	191	206	221	236	251
Other exempt wells	665	825	1,097	1,897	2,697	3,497	4,297
Exempt other demand	333	413	549	949	1,349	1,749	2,149
EFFLUENT SUPPLIES:	**92-95 AVE**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
NIWWTP Q[1](AZ) current use rate	5,019	5,472	5,773	6,074	6,375	6,676	6,977
NIWWTP Q (AZ) conserving	5,019	5,378	5,065	5,236	5,465	5,691	5,949
NIWWTP Q (SONORA)	11,169	12,692	13,603	13,600	13,600	13,600	13,600

[1] Q means the volume of effluent released from the plant.

APPENDIX 11C
EFFLUENT REDUCTION DUE TO SYSTEM IMPROVEMENTS
CITY OF NOGALES, ARIZONA
NOGALES, SONORA

I. Data Analyzed

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1990-1998
Total Use	4529	4147	4169	4218	4239	4290	4386	4482	4070	38530
GC Use	1003	591	550	415	455	529	632	755	692	5622
Total - GC	3526	3556	3619	3803	3784	3761	3754	3727	3378	32908
Sewerable Use	3526	3556	3619	3803	3784	3761	3754	3727	3378	32908
80% of Sewerable Use	2821	2845	2895	3042	3027	3009	3003	2982	2702	26326
US Influent	4448	5355	5194	5442	5170	5514	4494	4677	5617	45911
Influent/80% Sewerable	1.58	1.88	1.79	1.79	1.71	1.83	1.50	1.57	2.08	1.74

II. Nogales, Arizona Calculation

A. Assume the CDM figure of 20% reduction in water flowing into the sewer line from the surrounding water table.

1. 1990 - 1998 Average Sewerable Use = 32,908 acre-feet divided by 9 = 3656 acre-feet
2. 1990 - 1998 Average Sewerable Use x 80% = 3656 * .8 = 2925 acre-feet
3. 1990 - 1998 Average Influent = 45,911 acre-feet divided by 9 = 5101 acre-feet

4. 1990 -1998 Average volume of water inflowing into the sewer line from surrounding water table equals:

5. 5101 - 2925 = 2176 acre-feet

6. Assume a 20% reduction in 2176 acre-feet = 2176 * .80 = 1741 acre-feet remaining flow into sewer pipe after system fixes

7. Projected new ratio of influent to 80% of sewerable demand equals:
   a. 1741 + 2925 = 4666
   b. 4666 divided by 2925= 1.59

APPENDIX 11C *(continued)*
EFFLUENT REDUCTION DUE TO SYSTEM IMPROVEMENTS
CITY OF NOGALES, ARIZONA
NOGALES, SONORA

III. Nogales, Sonora Calculation

A. Influent from Mexico averages 10.0 mgd
B. Wastewater inflow is estimated to be 5.41 mgd
C. Inflow into the sewer pipe from surrounding water table is estimated to be 4.59 mgd
D. Items A-C are from CDM report, table 5.3-9 for 1996)
E. Estimated 1996 influent by Sonora = 10.0 million gallons/day * 365 days / 325,851 * 1,000,000 = 11,169 acre-feet annually
F. The estimated 1996 population of Nogales, Sonora is 186, 216 (from CDM).
G. Influent GPCD for Sonora = 11,169 / 186,216 * 325851 / 365 = 53 GPCD
H. If the inflow to the pipe is reduced by 20%, the new inflow to the pipe would equal:

4.59 mgd * .8 = 3.67 mgd

I. The improved system influent would then equal:

5.41 mgd + 3.67 mgd = 9.08 mgd

J. And the new influent from Mexico would equal:

9.08 * 365 days / 325851 * 1,000,000 = 10,147 acre-feet annually

K. And the new influent GPCD for Sonora would equal:

10,147 / 186,216 * 325851 / 365 = 49 GPCD

CHAPTER

12

Future Directions

12.1 INTRODUCTION

The "Future Directions" chapter provides an overview of water management issues which need to be addressed in the AMA and the Arizona Department of Water Resources' (Department) perspective on management approaches. This chapter also provides an overview of the future actions the Department proposes to address these issues.

The 1994 legislation establishing the Santa Cruz Active Management Area (AMA) called for the development of a comprehensive and well-balanced management strategy reflecting the unique goal and nature of the AMA. The legislature recognized three principal factors which make the AMA unique: (1) the goals of the community to protect the limited water resources of the AMA as well as the diverse habitat along the Upper Santa Cruz River, (2) the international nature of the water management issues facing the region, and (3) the need for coordinated management of surface water rights and groundwater rights to meet the management needs of the area.

In the development of the Third Management Plan, the AMA builds upon programs developed during the First and Second Management Plans and incorporates some new programs to help achieve the AMA goals. Additional programs will be developed in order to ensure the AMA continues to maintain safe-yield conditions and prevent long-term local water table declines. Some of these programs, such as future amendments to the Assured Water Supply Rules (AWS Rules) and adoption of additional well spacing criteria unique to the AMA, are already authorized by statute and are currently under development. However, development of other potentially necessary programs may be constrained by the Department's staff resources, legal authorities, and the degree of public support for the proposed programs.

Some of the water management issues and potential program concepts discussed in this chapter may fall outside of the Department's responsibility or authority. However, a comprehensive overview in this "Future Directions" chapter is an important contribution to meeting the water management challenges of the future.

12.2 A PERSPECTIVE ON WATER MANAGEMENT IN THE SANTA CRUZ ACTIVE MANAGEMENT AREA

The third management period is a turning point in water management for the Santa Cruz AMA, in that the provisions of the Groundwater Code (Code) are being reexamined to determine if adjustments need to be made to better correlate to the unique goals of the AMA. The separation of the Santa Cruz AMA from the Tucson AMA brings about the Santa Cruz AMA's own development plan. In this plan, criteria for assured water supply consistency with goal and well spacing rules are more closely tailored to the needs of the AMA.

Critical issues currently facing the AMA include the development of programs to assure sustainable water supplies, the settlement of surface water rights claims, the facility planning process for the treatment and disposition of wastewater from both sides of the border, the protection of core aquatic and riparian habitats, and the sustenance of a healthy economy.

The regulatory function of the initial Third Management Plan in the Santa Cruz AMA is primarily to describe conservation requirements for municipal, industrial, and agricultural users and to prescribe guidelines for the placement of new non-exempt wells. The statute also requires the inclusion of an augmentation program, a conservation assistance program and a groundwater quality assessment. The non-regulatory portions of the plan discuss the development of the AWS Rules and potential modifications to the well spacing rules and recharge program.

12.2.1 Hydrologic Conditions

The dual water management goal of the AMA is to maintain safe-yield conditions and prevent local water table levels from experiencing long-term declines. However, these goals will be an ongoing challenge because local water table levels fluctuate with variations in weather patterns, water withdrawals within the Santa Cruz River basin (in Mexico and in the United States), and incidental recharge from agricultural irrigation and wastewater treatment plant discharge. In order to assure dependable water supplies as the demand for this finite resource continues to grow, active management strategies must be developed. Prior to developing new tools for the Third Management Plan, it is important to have a clear scientific understanding of how natural processes and water systems within the AMA operate.

To improve the understanding of the hydrologic system in the Santa Cruz AMA, a hydrologic model is being developed by the Department. The model will be an important tool in evaluating demand strategies in a hydrologic system with such a high degree of seasonal and annual fluctuation in natural supplies. Data retrieved from this model may also prove useful in refining some of the natural water demand and supply estimates contained in this plan.

12.2.2 Water Demand Conditions

Water demand in the AMA is concentrated in the Younger Alluvium along the main channel of the Santa Cruz River. More than 90 percent of the water production in the AMA occurs in this area. The aquifer systems of the Santa Cruz AMA are generally shallow, with limited storage capacity, and are highly sensitive to prolonged periods of drought. These systems also rebound rapidly when sufficient surface flow allows recharge. The largest portion of the system is also heavily dependent on the continuation of effluent discharge from the Nogales International Wastewater Treatment Plant (NIWWTP) to sustain current water levels.

The water demand characteristics of the AMA are described in more detail in Chapter 3, including maps which illustrate that demand is concentrated within the Santa Cruz River channel or in close proximity. This characteristic, coupled with anticipated growth rates projected to continue well into the future, emphasizes the importance of developing additional water conservation and augmentation programs.

Efficient use of the water supplies is fundamental to achievement of the AMA goals. The Third Management Plan highlights the importance of water conservation in chapters 4, 5, and 6. AMA water supplies are limited and the water demand sectors will need to find innovative ways to maximize the use of the available supplies. The Department intends to be an active participant in this process.

12.2.2.1 Municipal Demand and Issues

Municipal water users in the Santa Cruz AMA are faced with a significant water management challenge in securing additional supplies to serve new growth. Water supplies must be long-term and secure to allow for additional development in the AMA, as in all AMAs. However, the Santa Cruz AMA is unique from other AMAs in that water from three sources (surface water, groundwater, and effluent) is commingled in the Younger Alluvium of the Santa Cruz River. This commingling of water combined with the AMA goal of preventing long-term declines in local water table levels will require a delicate and detailed management approach. The Santa Cruz AMA is also presented with unique problems because it has no access to imported Colorado River supplies.

In 1995 the Department adopted rules governing the issuance of assured water supply determinations. The AWS Rules apply to the Santa Cruz AMA and require that any certificates or designations issued be consistent with the goals of the AMA. However, because the AMA was established after the AWS Rules had been substantially completed, the AWS Rules do not currently include specific criteria for evaluating the consistency of the proposed use to the AMA goals nor do they include standards for determining physical availability in this unique hydrologic system. While the new criteria are being developed, Department staff will implement the rules on a case by case basis.

Future modifications of the plan may be necessary in order to better coordinate with the AWS Rules consistency with goal criteria when adopted for the Santa Cruz AMA. The municipal Alternative Conservation Program consistency with management goal criteria, specifically, may be more fully developed as the AWS Rules are modified for the AMA. In addition, the well spacing criteria included in this plan will be modified as additional hydrologic information is collected and analyzed and the hydrologic model for the AMA is completed.

Effluent generated by the NIWWTP is one of the most important renewable water supplies in the Santa Cruz AMA. It is fundamental to water management to assure the optimal use of present and future effluent flows. However, there are legal, economical, and governmental barriers that will need to be resolved to maintain or augment the current and projected effluent quantity discharged and maintain a supply which can meet the assured water supply needs of current and future users. Currently, about two-thirds of the effluent discharged to the Santa Cruz River is wastewater generated in Mexico. The Department has been working throughout its participation in the facility planning process to find a mutually beneficial agreement with Mexico to secure continuous effluent flow into the AMA, which will help to maintain water tables, recharge areas of high water demand, and preserve valued riparian habitat. The locally generated effluent is also an important resource that, used efficiently, will help to maintain the AMA goals.

In addition to the needs for water supply augmentation discussed above, the limited supplies available within the AMA necessitate an ongoing commitment to water use efficiency, conservation programs, and drought supply programs for emergency situations. To help efficiently manage water supplies the Department has encouraged the development of water conservation, reuse, and recharge as good water management tools for municipal water providers.

Another water management concern is the proliferation of wildcat subdivisions and lot splits, dry lot subdivisions, and small development creating new small water providers without sufficient resources. Large municipal providers are technically better prepared to implement water conservation, water quality, and reuse programs than are very small providers or the "dry lot subdivisions" where non-regulated exempt wells are used. "Dry lot subdivisions" are housing subdivisions which sell lots that have no access to a water distribution system. Each lot owner is responsible for providing his own water by means of an exempt well.

In addition to the concerns above, wildcat subdivisions, lot splits, and dry lot subdivisions of less than 20 lots are currently exempt from requirements that their use be consistent with management goals of the AMA. As this type of development occurs in the AMA, it can potentially impact water use and water rights closer to the Santa Cruz River and hinder the ability to maintain water levels when new exempt wells intercept the mountain front recharge which historically had replenished the Younger Alluvium.

12.2.2.2 Agricultural Demand and Issues

The agricultural sector is one of the largest water users in the AMA. During the third management period, the Department will provide the agricultural sector with technical and conservation planning assistance to reduce overall demand and help meet the AMA goals. The Department will investigate incentives for the direct use of effluent, and work to increase the accuracy of water withdrawal measurement and improve irrigation scheduling and efficiency.

As one method to increase the irrigation efficiency, the Department will work with agricultural users to develop a program which allows them to maintain their surface water rights without having to periodically over irrigate their fields.

The Department will also work with surface water rights holders to facilitate arrangements which provide drought protection to municipal users by compensating senior surface water rights holders who fallow their land during droughts.

One of the main issues confronting the Department has been the excessive accumulation of flex account credits. Because of this accumulation, most right holders may exceed their farm's maximum annual groundwater allotment and yet continue to be in compliance with the farm's conservation requirements. Under the Historic Cropping Program, flex account credit accruals are limited and more efficient on-farm water management practices are encouraged. During the third management period, the Department will examine whether additional alternative programs, with limitations on flex account credits, should be developed as authorized by legislation from 1998. Two possible alternative programs that will be evaluated during the third management period include a cropped acreage program and a best management practices (BMP) program. These programs may provide a farmer the ability to grow crops that more closely reflect current market demands.

12.2.2.3 Industrial Demands and Issues

In the industrial sector, the main water users are turf-related facilities (golf courses, parks, schools, and common areas with 10 or more acres of high water use landscaping). These facilities have opportunities to improve in their water use efficiency. Efficient water use, coupled with direct use of effluent for turf irrigation, would help to achieve the AMA goals. While effluent use is encouraged within the AMA, there is only a limited supply. This is one reason that new turf-related facility use is not encouraged.

12.2.3 Other Issues and Challenges

The lack of a final court decree on the adjudication of surface water rights claims on the Santa Cruz River does complicate the effective implementation of assured water supply and other water management programs in the Santa Cruz AMA. During 1999, local water users with surface water rights claims have been discussing a possible surface water rights claims settlement that could be proposed to the adjudication court for the adjudication and ranking of surface water in the Santa Cruz AMA.

The geographic location and the hydrologic characteristics of the Santa Cruz AMA have limited the development of augmentation projects in the AMA. Many of the current augmentation mechanisms developed in the Second Management Plan were designed to introduce a variety of renewable water supplies, in particular Central Arizona Project (CAP) water, to water users in central Arizona, a sizeable distance away from the Santa Cruz AMA.

The water supply augmentation alternatives available to the Santa Cruz AMA are limited. During the third management period, mechanisms must be generated to effectively develop the sources of water available. One of these mechanisms could be the creation of a water district that could help in moving water from the sources of supply to the areas of demand.

The creation of a replenishment authority or water district has been suggested in several forums, most recently by a group representing surface water interests in the AMA. The district would have the responsibility for maintaining continuously available supplies to meet the needs of basin water users and to achieve consistency with management goals. Such a management entity is envisioned as able to contract for Mexican effluent, contract with agricultural users to "fallow" lands during drought cycles, and assist in the severance and transfer of water rights for assured water supply purposes. Creation of any district will require specific legislation. The Department is committed to working with the community toward refining concepts and developing legislation to create at least the first phase of any necessary authority. To get to that point, however, a better understanding of the potential outcome of an interim surface water rights adjudication decree and the assured water supply determination process will be needed.

One of the water management tools that the Department has available is the general well spacing rules. The Department evaluates applications to drill new, "non-exempt" wells, or replacement "non-exempt" wells in new locations through general well spacing rules. Approval is granted only if the director determines that the proposed well ". . . will not unreasonably increase damage to surrounding land or other water users from the concentration of wells."

The Older Alluvium is the most laterally extensive water-bearing formation in the Santa Cruz AMA, extending miles out from the Santa Cruz River and its tributaries. While new municipal or industrial production wells or major new subdivisions are not causes of concern, the sale of 40-acre plots are. These 40-acre parcels could each be divided into eight five-acre parcels, a trend which has been noted in the AMA. If each five-acre parcel drilled one exempt well and withdrew 10-acre feet per year, water supplies could be quickly reduced and safe-yield conditions could become very difficult to maintain. Water tables in the Older Alluvium would decline with uncertain consequences for stream flow and water tables in the Younger Alluvium.

The statutes require the Santa Cruz AMA to include in its management plan for the third management period "criteria for the location of new wells and replacement wells in new locations consistent with the management goal of the active management area." A.R.S. § 45-566(A)(11). The Department's objective in including additional well spacing criteria in the Santa Cruz AMA Third Management Plan is to avoid negative impacts from the drilling of new wells or replacement wells in new locations under safe-yield conditions, to avoid long-term declines in local water table levels, protect other water users, and preserve the hydrologic balance. Certain types of wells, such as mineral exploration wells, geotechnical wells, monitor wells, and peizometers, are excluded from these well spacing rules. These types of wells do not pump significant volumes of water and are, therefore, excluded from the well impact rules and only require notices of intention to drill or groundwater withdrawal permits. As greater understanding of the hydrology of the AMA is achieved the Third Management Plan well spacing criteria may be modified.

12.3 WATER MANAGEMENT CHALLENGES IN THE SANTA CRUZ ACTIVE MANAGEMENT AREA

The Third Management Plan programs were developed within current statutory guidelines; however, as described in chapters 8 and 11, implementation of the conservation measures outlined in chapters 4, 5, and 6 will not go far enough to ensure sufficient water supplies for current and committed demands into the future. New and innovative management tools for quantification and clarification of water rights and new sources of supply will need to be developed to achieve the AMA goals. Chapter 11 outlines the volume of supply needed to ensure sufficient supplies even in times of drought. Chapter 11 also indicates the volume of water that might be available to be retained and stored during storm flow events if storage capacity in the AMA is increased and water moving through the AMA could be slowed to allow increased percolation to the water table.

To meet the AMA goals, new uses of water within certain areas of the Santa Cruz AMA will need to be offset either by replenishment of water withdrawn or through a corresponding reduction in water use by existing users. Replenishment could be through some mechanism to purchase recharge credits or in some circumstances by a demonstration that water pumped out of storage will be naturally recharged. Reduction in existing use could be achieved by discontinuing existing water use in the same local areas in which a new demand begins. Water that is conserved through increased efficiency could, in part, be taken up by a new use.

12.3.1 Coordinated Management of Surface and Groundwater

The legislature has mandated that management of groundwater and surface water rights be coordinated in order to achieve the AMA goals. This will likely result in a high degree of water management awareness by the local water right holders in the Santa Cruz AMA. To successfully manage water supplies for the Santa Cruz AMA, groundwater programs cannot be implemented without examining the consequences to surface water rights, and surface water rights cannot be obtained or altered without examining the consequences to groundwater programs and overall water management efforts and the public interest. Where the law allows the Department to consider these consequences in making its decision, the Department will do so.

Surface water rights in the AMA have not yet been adjudicated and under current procedures may not be adjudicated for many years. In March 1999, the AMA Settlement Group presented to the Department a set of proposed concepts for an assessment which would ultimately lead to an interim surface water rights decree for the AMA in advance of an adjudication. A water rights decree is very helpful for determining the legal and physical availability of water in assured water supply requests. The Department supports the Settlement Group's efforts to resolve these rights in a timely and equitable manner that meets the water management needs of the AMA.

Unlike other AMAs, the Santa Cruz AMA is largely dependent on surface water subflow as a source of supply, and there is a close connection between surface water and groundwater systems. In addition, there is limited storage in the aquifers underlying the Santa Cruz River and fluctuating water levels in portions of the Younger Alluvium of the Santa Cruz River where most of the region's water supply is located, making this source of supply highly susceptible to drought.

Shallow depths-to-water and small aquifer storage capacity produce rapid and dramatic fluctuations in water levels. Although this could be viewed as safe-yield when accounting for a long-term average of water conditions, the immediate impacts of water shortages extended over just a short period can be significant. This hydrologic reality also hinders the ability to accurately forecast future demands and supplies in the Santa Cruz AMA.

Although the laws governing surface water and groundwater are distinct, they are not necessarily at cross-purposes. An effective coordinated management of surface and groundwater must provide the mechanisms to protect the water rights held under both legal authorities.

12.3.2 International Water Issues

The international nature of the Santa Cruz AMA water resources requires binational coordination of water management efforts. The Santa Cruz River is one of the main water supply sources for Nogales, Sonora and for Nogales, Arizona. The water management policies of Nogales, Sonora, in regard to the use of the Santa Cruz River, may have a direct impact on the volume of water entering the Santa Cruz AMA. Additional pumping of Nogales, Sonora Santa Cruz River well fields could reduce both small flood flows and sub-flow, thereby reducing the recharge in the Santa Cruz AMA.

One key component of water management decisions in the Santa Cruz AMA depends on knowing the fate of current and future effluent discharge from Mexico. This effluent is an important portion of the overall balance of the hydrologic system in the AMA. Mexico currently has a legal right, through treaty agreement, to recover their portion of the treated effluent before it is discharged to the river. Although Mexico has not initiated efforts to recover the effluent, the uncertainty of Mexico exercising its right to recapture the effluent compounds the dilemma of whether or not this resource will be available to the AMA in the future.

The Department is participating in a binational facilities planning process that is challenged with finding an integrated solution to wastewater treatment problems in both Nogales, Sonora and Nogales, Arizona. A very important portion of the planning involves the effluent discharge from the NIWWTP. This effluent is generated by Nogales, Sonora and Nogales, Arizona. Roughly two-thirds of the effluent entering the NIWWTP originates from Nogales, Sonora and is transported into the United States through a pipeline which runs under the Nogales Wash. After treatment, the effluent has been historically discharged into the Santa Cruz River. This discharge is a significant component of the incidental recharge in the Santa Cruz River aquifer. Since the plant began operation in the 1960s, water levels have risen in the local water tables downstream from the plant.

There are several varying opinions of what approach the AMA should take in the planning of water resources downstream from the NIWWTP. Some opinions suggest that since the effluent has been historically discharged it will continue in the future. Another opinion is that the effluent has generated a rich riparian habitat and that most of the water that the riparian vegetation is consuming is water discharged from the plant, which limits recharge to the local aquifers. Another view is that in the future more effluent will be available from the continuous urban development on both sides of the border. All of these opinions raise valid concerns which the Department will work to address during the third management period. The Department will seek agreements with Mexico to further secure the supply of effluent. U.S. federal agencies are interested in reducing their subsidy to Mexico for treatment costs, which might be met by a replenishment district in the Santa Cruz AMA. Presently, federal money is being used to upgrade and expand the NIWWTP, to upgrade water systems, and possibly to build treatment capacity in Mexico.

12.3.3 Development Pressure

The City of Nogales and Rio Rico are the two biggest water users in the municipal sector. They have been growing at the rate of 5 to 8 percent per year for the last 10 years. If this rate of growth continues during the third management period, creative water management policies will be required to maintain the AMA goals and meet the new water needs.

During the third management period, greater development pressure may be coming from the north. Expansion of existing development in the Green Valley area is headed south. This development is already at the northern boundary of the Santa Cruz AMA and is expected to continue during the third management period. This type of development (residential with associated golf courses) requires the use of substantial amounts of water.

Development pressures probably will continue throughout the third management period. The local authorities (City and County) have the tools to direct and decide how this development will occur. The Department intends to maintain open communications with these authorities and will continue to provide advice on water supply issues related to development.

The Department has concerns about the possible future conversion of agricultural lands for development in the Santa Cruz AMA. Currently, agricultural water right holders are not using their full water allocations. These rights could be converted to residential use and be fully utilized by municipal users. The possible conversion of agricultural lands to municipal development could remove a vital source of incidental recharge and result in an increase in demand on the aquifers in the AMA.

There is an increasing concern about the development of dry-lot subdivisions in the Santa Cruz AMA. In this type of subdivision, each lot gets its water supply from an exempt well. Concentrations of exempt well demand often occur in the same general area as municipal demand. Exempt wells are usually located near the Santa Cruz River and other tributaries and away from hard rock areas. The pumpage associated with a cluster of several small wells within the same basin could potentially withdraw a similar volume as a single large well.

Concentrations of new exempt wells could potentially make it more difficult to achieve the AMA goals due to the possible effects of concentrated withdrawals and the lack of authority to regulate or even monitor information on the water use patterns from these wells. The dry-lot subdivisions also frequently have septic systems as a means of disposal of raw sewage. In some areas in the AMA, this may result in water quality problems due to shallow water tables. Finally, there is no potential to collect wastewater for water reuse in a dry-lot subdivision using septic systems.

A remaining issue that needs to be explored during the third management period is the potential to design a conservation program for private water companies that meets both the Arizona Corporation Commission (ACC) standards and the AMA water management goals. The Department will continue to work with the ACC in the development of policies related to water conservation and supply acquisition and on conditions for appropriate recovery of costs associated with the Department's regulatory programs.

12.3.4 Development of Technical Data and Tools

The Department continues to devote considerable resources to the development of the groundwater flow model for the AMA. In terms of the number of model cells, it is the largest flow model yet developed by the Department with 10 times the number of model cells as the Salt River Valley model. Due to its complicated nature, a considerable amount of detail is necessary to accurately simulate the hydrologic system. This work will help in conceptually understanding some of the relationships between the Younger and the Older Alluvium.

In addition to the groundwater flow model, the Department has now begun development of a surface water model for the AMA. This model will be able to compute inflows and outflows for every defined segment of the Santa Cruz River system. Instead of predicting water levels, the model balances water demands and inflows taking into account agricultural and municipal diversions, surface water claims, evapotranspiration, storage, and other factors. Once the model is running and calibrated, it could become an important tool in evaluating the effects of existing and future water claims on the river. This could help the settlement negotiations considerably.

The available information on the hydrologic characteristics of the Older Alluvium and its potential as a water source for the Santa Cruz AMA is very limited. Few high production wells are located in the Older Alluvium and the exempt wells located there are not required to provide water use characteristics to the Department. The Older Alluvium stores large amounts of water, but it does not usually transmit large quantities of water to wells. Further exploration to find areas with high water yield and storage capacity would be useful. The Department intends to direct more attention to developing a better understanding of this hydrogeologic unit during the third management period.

12.3.5 Development of Assured Water Supply Criteria

A major work effort will be initiated to establish the assured water supply criteria for evaluating the statutory requirement that issuance of an assured water supply must be consistent with the AMA goals. In order to develop the appropriate criteria, it is necessary to have: (1) a better understanding of the impact of diversions at specific locations of the subflow water levels; (2) a better understanding of the impact of the effluent introduced into the system and its long-term availability; (3) a better understanding of how effluent, surface water flows, and mountain front recharge affect Younger Alluvium water levels; and (4) a formal determination of the nature, validity, and priority of surface water rights in the context of their usage in supporting an assured water supply determination.

The assured water supply standards in the Santa Cruz AMA could significantly differ from those in place for other AMAs. For the other AMAs, the rules are focused predominantly on limiting groundwater withdrawals from deep, basin-filled aquifer systems that have been experiencing significant depletion. The current assured water supply standards for those AMAs allow for significant localized groundwater mining (to 1,000 feet below land surface).

In the Santa Cruz AMA, the majority of the water use is in the Younger Alluvium and its tributaries. One portion of the Santa Cruz AMA goal seeks to maintain local water tables. While water may be "physically available" to an entity, the goal of maintaining the water level could significantly limit allocation of water for new development. A major challenge in developing the assured water supply standards for the Santa Cruz AMA's unique hydrologic system will be to determine the volume of water that can be removed from the system without allowing long-term water table declines while taking into consideration the natural fluctuations in supply and demand and current water rights.

The Department is beginning the process of drafting rule criteria for the AMA. Final adoption of these rules will reflect community and stakeholder input to the highest degree possible. We expect to have an initial conceptual draft available for discussion before the end of 1999. These rules will likely need to be modified in the future years as the program evolves.

12.3.6 Augmentation/Recharge Limitations

The hydrogeologic characteristics of the aquifers in the Santa Cruz AMA and their close relationship with surface water flow presents a challenge to augmentation and recharge that needs to be addressed with innovative approaches. Effluent discharge from the NIWWTP is a major source of recharge in the AMA, and it is a significant source of water available to support future assured water supply determinations. Additionally, the effluent plays a major role in maintaining water tables and riparian habitat in the Younger Alluvium downstream of the NIWWTP.

Any proposed recharge facility must be hydrologically feasible. In the Santa Cruz AMA, the main concern relative to hydrologic feasibility is the lack of storage capacity in the Younger Alluvium. In addition, water that is recharged in the Younger Alluvium may eventually flow out of the AMA. Any recharge water that leaves the AMA would be debited from the long-term storage account of the water stored. In the Santa Cruz AMA, there are two key issues that must be resolved in the accounting of storage credits. One issue is whether or not the recharge statutes allow credits to be earned for water recharged in a surface water system. The second issue is how the Department will quantify how much of the recharged effluent leaves the AMA in order to deduct that amount from the credit account.

Historically, the major challenges of water management in the desert have required creative, innovative solutions. These are attributes which Arizona communities and state government have successfully used thus far. These attributes will continue to be important as we face a future of population growth and intensifying competition for limited water resources.

12.4 STRATEGIES FOR THE THIRD MANAGEMENT PERIOD

The Department, in conjunction with the Santa Cruz AMA Groundwater Users Advisory Council (GUAC), has solicited the local community's interpretation of the water management goals established by the legislature. The Department intends to continue an open dialog with the local water users and the community in general during the third management period.

The Department's water management programs will be focused on protecting the overall balance between water use and replenishment of the underlying aquifers and on accommodating short-term fluctuations in water tables due to climatic conditions.

The Department intends to concentrate water management efforts on the Younger Alluvium of the Santa Cruz River and those tributaries and formations that contribute water to the Younger Alluvium, based on the input from local water interests, and because most of the critical water management issues are centered upon the Younger Alluvium of the Santa Cruz River.

The Department will continue to implement the AWS Rules to require new subdivisions to use renewable supplies and to be consistent with both the safe-yield and the local water table goals. For the Santa Cruz AMA, this primarily means the use of a surface water right which has been severed and transferred to the new use.

The assured water supply and well spacing programs are some of the tools that the Department intends to use to prevent negative impacts of new non-exempt wells on existing water right holders and the AMA's safe-yield and water table goals. During the third management period, the Department will continue working to improve the understanding of the potential impact of exempt wells on neighboring supplies and the riparian areas.

The Department is developing a computer groundwater model and gathering hydrogeologic information to get a better understanding of the hydrologic systems in the AMA. This groundwater model will be a valuable tool in guiding the decisions of water users and the Department during the third management period. The Department intends to develop coordinated management of surface water and groundwater by adapting the existing programs or by developing new management approaches over the next 10 years.

The Department will continue to represent the AMA's interest in the facility planning negotiations and seek mutually beneficial agreements with Mexico to further secure the supply of effluent.

12.4.1 Water Conservation-Related Strategies

To enhance the Department's water conservation efforts, the Department will investigate the need for the development of additional alternative agricultural conservation programs during the third management period.

The Department will also continue to monitor crop and water use patterns during the third management period to evaluate agriculture's contribution to meeting the Santa Cruz AMA goals and the impacts of the Department's programs on farming operations. Urbanization impacts on agriculture as well as water use trends due to agricultural market conditions will be evaluated for future planning needs.

The Department will investigate the need for legislative changes to enhance the Department's conservation efforts and the impact on farming operations.

The Department will work to improve data collection and analysis of municipal growth patterns, continue to search for the best available technology in residential and non-residential water use, and further quantify what a reasonable goal is for future reductions in municipal water use. The Department will evaluate the contribution of the municipal sector on the achievement of the AMA goals and continue to explore the possibility of developing a separate private water company program in coordination with the Arizona Corporation Commission. The Department will persist in the development of water management tools to assist the water users in the Santa Cruz AMA to achieve its goals and preserve the quality of life.

A significant increase in the volume of water withdrawn from wells, particularly in the Younger Alluvium of the Santa Cruz River, may prevent the maintenance of safe-yield conditions and result in long-term declines in local water table levels. The current Code provisions may need to be modified to allow the Santa Cruz AMA to most effectively use conservation to manage for its dual goals.

A stronger conservation-oriented technology and water management practices requirement for turf-related facilities should be considered from both a regulatory and non-regulatory approach. From a regulatory perspective, application rates which determine the maximum annual water allotments need to be further scrutinized under actual field conditions. Conservation technologies and practices should be further evaluated as well. From a non-regulatory approach, increased conservation and augmentation education could assist turf managers with water management practices, evaluation of effective water conservation technology, and construction of effluent conveyance infrastructure.

The turf facilities make up the majority of the water demand in the industrial water use sector. The Department will continue the turf conservation program based on a maximum annual allotment for each facility and reduction of turfed acreage incentives. The Third Management Plan will provide incentives for the use of effluent by turf facilities. The Department will continue to provide additional conservation assistance and education for increased water management efficiency.

12.4.2 Water Supply Strategies

Recharge will be an important feature of any plan designed to meet the AMA management goals. However, statutory, physical, financial, and institutional constraints must first be addressed and resolved. An ideal solution would likely involve a combined approach whereby some effluent is recharged in constructed facilities near demand centers, some is directly reused for irrigation or turf watering, and the remainder is recharged to the river to support the riparian habitat and recharge the aquifer for downstream uses. A regional water management entity such as that described in Chapter 8 could assume responsibility for operating these projects with the objective of balancing competing water needs.

New water demands and the uncertain future availability of Mexican effluent highlight the need for the local community to work together with the Department to secure this and other renewable supplies, where available, to achieve and maintain the management goals of the Santa Cruz AMA. The Department is and will continue lending its technical expertise and full resources to the exploration of solutions to the water resource management concerns of the Santa Cruz AMA community.

In addition, the Department will support funding for water conservation and augmentation education and the direct use of effluent supplies in order to meet the water management goals of the Santa Cruz AMA. These monies may be used to assist farmers with irrigation water management practices and for the infrastructure to convey renewable water supplies to farms.

12.4.3 Recharge/Augmentation Strategies

During the third management period, several augmentation measures will be explored including: (1) the evaluation of recharge sites in the Santa Cruz AMA; (2) possible water exchanges through state mechanisms such as the Arizona Water Banking Authority; (3) helping the AMA community explore the possibility of securing future effluent flow from Mexico, probably through the assistance of a locally created replenishment district; and (4) the possible use of existing renewable supplies within the AMA such as water from Patagonia Lake.

Ultimately, it is the Santa Cruz AMA community, however, that will determine what augmentation measures are needed to assure adequate water supplies in the future. By developing avenues from which local water interests can work together to promote improved water resource management and secure the long-term availability of water supplies to support existing and new development, the Department can help the Santa Cruz AMA successfully maintain the conditions set forth in its management goal.

12.4.4 Water Management Assistance Strategies

Additional research is needed on the effectiveness of water conservation programs. To the extent feasible, the Department will assist in designing follow-up studies and analysis to evaluate program effectiveness. This may be assisted through some funding from the Water Management Assistance Program for municipal research or evaluation projects. Throughout the third management period, the Department will work to improve water use data collection to support both planning and conservation program evaluation efforts. The Department will also continue to provide direct conservation assistance to water providers to help them in meeting their regulatory requirements.

The Third Management Plan will place a greater emphasis on studying replenishment options and expanding monitoring programs to assist in solving the unique water management problems of the Santa Cruz AMA and to increase public awareness of the importance of replenishment, monitoring, and water conservation. The Department, in consultation with the GUAC, will identify augmentation and replenishment, monitoring, and conservation assistance projects with the highest priority. These projects, through applications or Department initiative, will receive "first funding" status. Additionally, the Department will list other priority projects and categories for technical or funding assistance. Applications in this priority category will compete with all other applications; however, preference points will be given to the priority applications.

12.4.5 Well Spacing Strategies

The Department will evaluate new non-exempt wells and replacement wells in new locations based on the hydrologic impact analysis submitted by the applicant and the most recent hydrologic data for the local area. If, at any time until the management plan well spacing criteria are finalized through a modification of the plan, the Department determines that a proposed well will have a negative effect on the maintenance of local water table levels and safe-yield conditions, the Department may refuse to issue the permit unless the applicant can demonstrate through a hydrologic study that the proposed well will not have a negative impact on the AMA goal.

The Department will continue evaluating new and existing hydrologic data pertaining to the potential impacts of exempt wells. Exempt wells have the capacity to pump 35 gallons of water per minute or less and may pump no more than a total of 10 acre-feet per year. Exempt wells are not regulated for water conservation, are not required to measure and report withdrawals, and are not subject to the Department's well spacing criteria.

12.4.6 Replenishment/Water Authority

The Department is committed to work with the community toward refining concepts and developing legislation to create at least the first phase of any necessary authority. To get to that point, however, a better understanding of the potential outcome of the surface water rights decree and assured water supply determination process will be needed.

12.4.7 Surface Water Rights

The Department supports the Settlement Group's proposed concepts for an assessment which could lead to an interim surface water rights decree for the AMA in advance of an adjudication. The Department is committed to continuing to work with all parties in the AMA toward completing a resolution of the water rights claims in the basin.

12.5 CONCLUSIONS

The creation of a successful management program will depend on the cooperation and commitment of all participants - government entities at local, state, federal, and international levels; water users; water providers; and the community - in refining goals, developing tools, and implementing program features. This complex effort will require several years to complete. The Department is firmly committed to working with interested parties and to dedicate the necessary resources to get the job done. We anticipate that several milestones or interim targets will need to be set along the way as we progress.

The limited water resources available in the Santa Cruz AMA will require efficient use of water by all the water use sectors. A continuous dialog with Mexican water agencies to find mutually beneficial management alternatives for the Santa Cruz River will be required. The exploration of recharge and augmentation possibilities will be a key tool to meet the AMA goals.

The Department's participation and assistance to the surface water users in reaching a settlement in their surface water claims is very important since the lack of a final court decree on the adjudication will affect the implementation of several water management programs in the AMA.

The comprehensive gathering of hydrologic information is of great importance to better develop the groundwater and surface water models that will provide information to assist in making water management decisions in the AMA.

A united position from the Department and the water users in the AMA will be required if new legislation is desired to address some of the water management issues in the Santa Cruz AMA.